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On the Indian methods of working Iron and Steel, for the Damascus Gun-barrels and Sword-blades. By Capt. MICHAEL EDWARD BAGNOLD, *of Bombay.*

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

On the Damascus Gun-barrels.

The gun-barrels made at Bombay, in imitation of Damascus, so much valued by the Orientals for the beauty of their twist, *are manufactured of iron hoops, obtained from European casks, mostly British.* The more these hoops *are corroded with rust*, they are proportionably acceptable to the workman: should there be any deficiency of this necessary oxydation, they are regularly exposed to moisture, until they are sufficiently prepared for welding. Being cut into lengths of about twelve inches, they are formed into a pile, an inch or an inch and a half high, laying the edges straight, so as not to overlap each other: a longer piece is then so fitted as to return over each end, and hold the whole together in the fire. This pile is then heated to a welding heat, and drawn out into a bar of about one inch wide, and one third of an inch thick; it is then doubled up in three

or more lengths, and again welded and drawn out as before: and this operation is repeated generally to the third or fourth time, according to the degree of fineness of twist required. The bar is then to be heated about a third of its length at a time, and being struck on the edge, is flattened the contrary way to that of the stratification. This part of the operation, brings the *wire* or *vein* outwards upon the strap. The barrel is then forged in the usual way, but much more jumping* is used, than in the English method, *in order to render the twist finer.* The most careful workmen always make a practice of *covering the part exposed to the fire with a lute, composed of mud, clay, and the dung of cows or horses, in order to guard against any unnecessary oxydation of the metal.* When the barrel is completed, the twist is raised, by laying the barrel, from one to five days, either in vinegar, *or a solution of the sulphate of iron,* until the twist is raised; this process is called *the wire twist.*

To produce the *curl,* the bars or straps are drawn into bars about three quarters of an inch square, and twisted, some to the right and others to the left hand; one of each sort is then welded together, doubled up and drawn out, as before described; and, according to the skill and experience of the workman, any intricacy of twist is produced, by this drawing out, doubling and twisting.

Sometimes, to save trouble, and economise the iron thus prepared, the artist will rough file an English barrel, weld a strap of Damascus iron spirally round it, or several straps are laid longitudinally along it, and welded on. *A native artist never works with pit coal, under any consideration: charcoal from light wood, forms his only fuel.*

On the Damascus Sword-blades.

In making the sword blades, there are several methods used; some workmen make a pile of alternate layers of softer and harder cast-steel, with powdered cast-iron mixed with borax, sprinkled between each layer.† These are drawn out to one-third more than the length of the intended blade, doubled up, heated, twisted, and re-forged several times; the *twist is brought out* in the same way as that in the gun-barrels, namely, by the use of vinegar, or a solution of sulphate of iron.

Some sword-blades are forged out of two *broad* plates of steel, thus prepared, with a *narrow* plate of good iron welded between them, toward the back, and thus leaving *solid steel for the edge,* of a considerable depth.

Others prefer to make them of one plate of steel, with a lamina of iron on each side of it, to give them strength and toughness.

Swords of this description were tempered in my brother's presence, in the following compound; and, as he states, with considerable effect.

* Or *upsetting endways,* by striking the barrel against the side of the anvil, whilst it is of a welding heat.—*Editor Tech. Rep.*

† *The soldering steel or iron with cast-iron and borax, and welding afterwards,* thus seems to be *an Eastern practice.*

The Hardening Composition.

The blade was covered with a paste, formed of equal parts of barilla, powdered egg-shells, borax, common salt, and crude soda, *heated to a moderate red heat; and just as the red was changing to a black heat, quenched in spring-water.*

From the information of the workmen, it appears that Damascus obtains all its steel from the upper part of the Deccan, where it is called *fonlode hind*, or Indian steel, of which there are great quantities, but little or no demand for it. The *Damasque* (or *joar*) is natural to this steel; and the veins in it are raised by immersing the blades in acid solutions.

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*On the Manufacture of Cobalt Blue.**

This fine colour, called from its inventor, "*Bleu de* THENARD," may be substituted for ultra marine, or the blue colour made from *lapis lazuli:* it appears to be, according to Thenard, a composition of alumine and oxide of cobalt. To prepare it, we must first procure a nitrate of cobalt; which is obtained for this purpose, by the following process.

We take the cobalt ore, which is composed of cobalt, arsenic, iron, sulphur, and a very small quantity of nickel, and having reduced this to powder, it must be calcined in a reverberatory furnace. In order to profit by the heat of this furnace, it is usual to make many successive operations; so that, after having withdrawn the calcined mineral, it may be re-charged with a fresh quantity. We must be very careful to stir it frequently during its calcination, so that every part may be successively exposed, as equally as possible, to the action of the heat. The chimney of the furnace must have a good draught; so that all the constituent principles of the mineral may be calcined, and the volatile products of the combustion, be carried off in the current produced by this draught. We thus disengage a great quantity of the oxide of arsenic, in the form of white vapours, and of sulphurous acid gas. The roasting is continued, until the arsenical vapours are no longer disengaged, which is easily ascertained as follows:—by collecting in a ladle, a little of the gas from the interior of the furnace, we find when the garlic odour of the arsenic has ceased to be given off: we then withdraw the calcined mineral from the furnace, and obtain a mixture of the oxides of cobalt, iron, and nickel; retaining in combination, arsenic in the state of oxide or acid; and mixed also with a portion of the mineral, in an unaltered state.

The operation of calcination being finished, we slightly boil the result, in an excess of weak nitrous acid, in a balloon or matrass of glass; and, after having decanted the clear supernatant liquid, we evaporate the solution, thus obtained, nearly to dryness, in a capsule of porcelain; or, perhaps, still better, of platina: we then throw this residuum into boiling water, and filter it, for the purpose of sepa-

* From the *Dictionnaire Technologique.*

rating from the solution, the arseniate of iron, which had precipitated during the operation, and then pour into the clear liquor, a solution of sub-phosphate of soda; which, by decomposing the nitrate of cobalt, affords, instead of the soluble nitrate of soda, an insoluble phosphate of cobalt, which precipitates.

This precipitate is of a violet colour; and is susceptible of changing to a rose colour, by remaining under water. After having well washed it, on a filter, we collect it together *whilst it is in a gelatinous form*, in order to mix it, in the most uniform manner possible, with eight times its weight of alumine (or the hydrate of alumina) *in the same state*. If the mixture has been properly made, the paste will have a perfectly uniform tint, throughout its whole mass. We then spread this mixture on smooth plates, and put them into a stove; and when it is become sufficiently dry, so as to be hard and brittle, it is pounded in a mortar, and exposed to the action of heat, in a covered earthen crucible. After being heated to a cherry red, for half an hour, we withdraw the crucible from the fire; and ought to find, on opening it, the beautiful blue colour which we purposed to obtain: which we then put, in this state, into a bottle, in order to preserve it for use.

This operation constantly succeeds, provided that we have attentively observed all the precautions pointed out; but above all, that the alumine, *in the gelatinous form*, shall have been precipitated from the alum, by a sufficient excess of ammonia; and that it has been well washed, with very pure water, (such, for instance, as shall have been obtained by filtering it through charcoal,) until it is completely purified.

We may employ, for the preparation of this colour, the arseniate of cobalt, instead of the phosphate; only observing to mix it with sixteen times its weight of alumine, instead of eight only. To obtain the arseniate of cobalt, we begin by preparing a solution of cobalt in the nitric acid, by the method which we have above described; adding to it, a solution of the arseniate of potash, until it no longer precipitates, as in the former case. The exchange between the oxides and the acids of the two salts, will take place in the same manner; and the operation will be finished, by following, in all respects, the directions we have before given.

If we also intimately mix, in the relative proportions above described, the alumine and the nitrate of cobalt,—the alum with a base of ammonia, and the nitrate of cobalt in solution in water,—evaporating the mixture to dryness, and afterwards calcining it in a crucible, we also obtain a colour analogous to the preceding; which tends to prove that the blue colour from cobalt, is merely a mixture of the oxide of cobalt and alumine. The blue colour obtained by this last process, is, however, paler than that which results from the two others. P.

On washing and cleansing Linens, &c.

TO THE EDITOR OF THE LONDON JOURNAL OF ARTS, &C.

SIR,—As the labour of washing and cleansing of linen, cotton, and other articles of wearing apparel, or furniture, forms no inconsiderable feature in the domestic business of every family, and is also a process that occurs in many manufacturing establishments, perhaps you may not think the following observations upon that subject, unworthy of a place in your Journal of useful Arts.

Being a proprietor of extensive works, connected with the manufacture of linen cloths, and a bleacher by profession, I am tolerably well acquainted with the operations of cleansing, and whitening such fabrics, and with the advantage of different processes in the accomplishment of that object; which may, perhaps, exempt me from any suspicion of ignorantly proposing methods which would be detrimental to the articles operated upon. I cannot, however, for a moment doubt, but that the female part of the community will, from early prepossessions, object to any process differing from their usual practice; yet I must be allowed to state the result of experiment, and leave the housewife to reject or adopt my plans, as she may think proper.

The number of females connected with our works, who were frequently engaged in the business of washing for their families, and the time so employed to the hindrance of our manufactory, induced me to project some plan by which this labour might be reduced, and in so doing I have been fortunate enough to confine this business to less than one-fourth the number of persons who were formerly engaged in it, and also to lessen the quantity of soap expended, as well as shorten the time of operation.

My process is this; let the articles intended to be washed, be assorted according to their qualities of fineness, and having done this, put them into different vessels containing warm water, at the temperature of about 100 or 130 Fahrenheit; in this water, dissolve about one-third or one-fourth of the soap which would be required to wash in the ordinary way, and to this a small quantity of pearl ashes must be added. The clothes being entirely covered with this liquor, let them remain in soak for thirty-six or forty-eight hours, after which, they are to be taken out of the liquor, and rinsed well in clean cold water, giving them a slight wringing, so that but little of the water may be retained in the clothes.

A boiler containing as much water as will cover the clothes, intended to be washed at one operation, is now to be heated to about 100 degrees Fahrenheit, and the remaining quantity of soap, (about two-thirds the sum used in all,) with a little pearl ashes, must now be introduced. When the soap is sufficiently dissolved, the clothes may be put into the liquor, taking care that the finer articles are all kept by themselves, and operated upon first. The temperature of the liquor must now be gradually raised to the boiling point, during a space of twenty minutes or half an hour, not faster; then let the

whole boil for fifteen or twenty minutes, after which the first lot of clothes may be taken out, and deposited in a vessel containing warm water. Retaining the ley from the first boil, now fill up the vessel with water, and then introduce the next coarser kind of articles, and operate upon them as above.

The clothes thus treated are then to be carefully examined, and if any spots remain, which seldom happens, they are to be washed by the hand, giving the whole a slight rub in the common way. This process of boiling, (contrary to the common prejudice,) will so effectually dislodge every greasy and dirty part, that more than three-fourths of the business is effected without any rubbing whatever; and the clothes are ultimately rendered perfectly clean, by merely rinsing in cold water.

By these means, as I have before said, the labour and expense of washing have been greatly diminished in our establishment, and the clothes preserved from that very serious injury, which they suffer from rubbing between the hands, which separates the fibres of the threads, and destroys the fabric of the clothes, in a much greater degree than they can possibly experience by ordinary wear.

I am, Sir, yours, &c. M———

Dundee, June 26th.

An account of the mode of welding together two pieces of cast steel, or of iron and cast steel, &c. which has been successfully practised. By A. Seibe.

TO THE EDITOR OF THE LONDON JOURNAL.

'Sir,—Having observed in your Journal, an account of welding together the edges of thin Plate Iron, and understanding that the material used as a flux, is considered to be a secret, and confined to the few persons who practice it; without knowing any thing of the materials employed at Birmingham, or in America, I beg to inform you that I have invented, and for some years practised a mode of welding together two thicknesses of cast steel, or iron and cast steel, which process of welding is performed at a temperature very little above a red heat.

'I send you herewith, several specimens of welding two pieces of cast steel together, of iron and cast steel, and of thin sheet iron alone; and also an account of the process and materials employed.

'I melt borax in an earthen vessel, (not in a metallic one, particularly brass or copper;) after melting, one-tenth of sal-ammoniac is pounded and mixed with it: the two substances being well incorporated together in the fire, it is to be poured out on to an iron plate, and when cold, will produce a substance resembling glass; it is then to be pulverized, and mixed with an equal quantity of unslaked lime, which makes it fit for use.

'In performing the operation of welding, the iron or steel must first be heated to a red heat, and then the pounded material scattered upon the surface, which will melt and run over it like sealing wax.

The iron or steel is then to be again introduced into the fire, and raised to a heat considerably below the ordinary welding heat, (which proves itself by the cast steel) when it is to be withdrawn, and immediately beaten by a hammer, until the surfaces are perfectly welded together.

'The composition is an invention of my own, and I have proved it for some years with never-failing success. Anxious to add my mite from time to time, to the advancement of the Arts, if this piece of information is considered by you as deserving a place in a scientific work, it is very much at your service, and the service of the public.

I am, Sir, Yours, &c.

AUGUSTUS SEIBE.

On the Comparative Advantages of employing Band-wheels, Spur-wheels, and Bevel-wheels, in Machinery. By Mr. JOSEPH BACKWELL, *Engineer.*

SIR,—I believe that the difference in the friction between band-wheels, spur-wheels, and bevel-wheels, has never been ascertained from actual experiment; at least, I am not acquainted with any publication on this interesting subject. The following results, which I obtained from an experiment made on purpose, will contribute, in some degree, to point out the very great advantages, and disadvantages, attending the employment of these different methods of actuating machinery. Two band-wheels of equal diameter, and mounted upon horizontal shafts 15 feet asunder, were driven by a leather band or strap, one inch broad; and I found that, by suspending a weight of four pounds to a line passing over a pulley, I could overcome the friction, and put them into motion. Two equal-sized spur-wheels, of cast-iron, with their teeth pitched, and dressed or trimmed, in the usual manner, and working into each other, at the same velocity as the two band-wheels, required five pounds weight to keep them in motion. On fitting two bevel-wheels, of cast-iron, also of equal diameters, upon two other shafts, they required a weight of seven pounds to give them a similar velocity with the others: and thus, the spur-wheels required one pound more to put them into motion, than the strap or band-wheels did; and the bevel-wheels, three pounds more.

I connected other and similar machinery to these shafts; and found the same proportional weights requisite to overcome the friction, and to put them into motion, as when they ran empty.

Of course, with other proportions, or differences in the diameters of the two wheels, the results would vary: still, the above may serve to show the comparative advantages of employing band-wheels, in preference to spur-geer; and spur-geer in preference to bevel-geer, where we have it in our power to make an election: and, in fact, *wherever bevel-wheels can be dispensed with, they ought never to be employed.* [*Tech. Rep.*

ON ENGRAVING.

(From the Mechanic's Gallery, By C. F. Partington.)

(Continued from p. 331, vol. i.)

On Copying Drawings, and using the Graver.

There are various methods by which those who are ignorant of the art of drawing, may copy, very accurately, the outlines of pictures, prints, and drawings; and these methods are often useful to those who can draw, and to engravers, when either great expedition or great accuracy is required; though none of them should ever be used by one who is learning to draw.

To trace against the light, hold the drawing you wish to copy against one of the panes of the window, or have a pane of glass put in a frame, and fitted up like a music stand, with a candle behind it. Lay your paper over the drawing, and you will see all the lines of the original distinctly through it, by which means you can easily trace them with a pen or black-lead pencil.*

The following simple instructions will sufficiently explain the mode of enlarging and contracting by squares.

Divide the sides of your original with a pair of compasses into any number of equal parts, and rule lines across with a black-lead pencil from side to side, and from top to bottom. Then having your paper of the size you intend, divide it into the same number of squares, either larger or less, as you would enlarge or contract it. Then placing your original before you, draw, square by square, the several parts, observing to make the part of the figure you are drawing fall in the same part of the squares in the copy as it does in your original. To prevent mistakes, number the squares both of the original and copy. This method is much used by engravers.

To prevent the necessity of ruling across the original, which in some cases may injure it, take a square pane of crown glass, and divide its sides, and also its top and bottom, into equal parts: then from each division draw lines across the glass with lamp-black ground with gum-water, and you will divide the glass into squares. Then lay the glass upon the original which you wish to copy, and having drawn the same number of squares upon your paper, proceed to copy into each square on your paper what appears behind each corresponding square of the glass. Instead of a glass, an open frame with threads stretched across will answer the same purpose.

The different kinds of engraving on copper may be thus briefly enumerated.

* To make tracing paper, mix together equal parts of oil of turpentine and drying-oil, and with a rag rub it evenly over some tissue-paper, or any other very thin paper. Hang it by to dry for a day or two, and it will be fit for use. Lay this over the print or drawing you intend to copy, and you will see every line distinctly through, so that you can go over them with the black-lead pencil. If you wish to do it in ink, you must mix a little ox's gall with the ink, to make the paper take it, which it would not otherwise do on account of the oil.

1. Engraving in strokes with a point, the copper-plate being covered with a ground, and the strokes afterwards corroded with aqua fortis. 2. In strokes, with the graver alone, unassisted by aqua fortis. In this instance the design is traced with the dry point (which is a sharp tool) upon the plate, and the strokes are cut in the copper by the graver. This is generally called engraving with the tool and dry point, only. 3. In strokes, but which are first etched with aqua fortis, and then finished with the graver: by which the two former methods are united. This mode is the most universally practised, and has also the best effect. 4. In dots, without strokes, which are performed with the point upon the wax or ground, and then bitten-in with aqua fortis, as in etching; but they are afterwards harmonized and softened with the graver, by making several small additional dots between them. Sometimes this mode of engraving is effected with the graver only, unassisted by the point, which is very often the case in the flesh, and the finer parts of portraits. 5. In dots, which are first etched as the foregoing, but afterwards harmonized by the dry point, performed by a little hammer, instead of the graver. This operation is called *opus mallei*, or the work of the hammer. It was practised by Lutma and others, but is now nearly exploded. 6. In mezzotinto, which is performed by covering the plate with a strong dark ground, or deep shade, by means of a toothed tool, and corroding the dots with aqua fortis. The parts which are to be light, are then rendered more or less smooth, by the scraper, according to the degrees of light they are to represent. 7. In aqua tinta, which is a newly invented method of engraving, but has suddenly attained a degree of perfection seldom the lot of recent discoveries, the outline is first etched, and the plate afterwards corroded; but in a different manner from either etching or mezzotinto, as will be explained hereafter.

The surface of the copper-plate designed to be engraved, should be perfectly polished, very level, and free from every imperfection. When the plate is ready, the next point is to transfer to it an exact copy of the outlines of the design to be executed. For this purpose, heat the plate in an oven, or hold it over one or more candles, till it will melt white wax, a piece of which should then be rubbed over it, and allowed to spread till it forms a thin uniform coat over the whole surface; after which, the plate may be left upon a table, till it is cool. In the mean time, take a piece of transparent paper, and fastening it upon the original design, in the usual manner for tracing, draw the whole of the outlines in the most accurate manner, with a black-lead pencil. The outline thus sketched, may be turned down upon the white wax, with which the plate is coated, and upon its being subjected to the action of a press, such as is used for packing, or kept between several thicknesses of paper, under a heavy weight, for an hour or two, on taking it out, the lines on the transparent paper will be nearly eradicated, but a lively copy of them will be found transferred to the white wax on the plate, in the reversed position, which is necessary to make an impression of the finished plate, resemble the original. The pencil marks on the wax, being now traced with a fine

steel point, so as just to touch the copper, the wax may be melted off, and a perfect outline of the design, will be found on the plate. When any small, subordinate part of a design, is to be transferred to the plate, the process is the same, except that the transparent paper is merely held down on the plate, and rubbed on the back with the burnisher instead of pressing.

It is now necessary to use the graver, the knob of the handle of which should rest against the hollow of the hand, the fore-finger extended towards the point, the thumb on one side, and three fingers on the other, in such a manner that the graver may be applied flatly to the plate, pressed forward with greater or less force, or wholly stopped, as occasion requires, in any part of its progress. The annexed engraving may, however, best illustrate the operation.

In forming straight lines, the plate should lie steadily upon the cushion; in forming curved lines, sometimes the plate only must be moved, while the graver is held steady; at other times both the graver and plate must be moved, according as the artist finds he can with most freedom, produce the desired effect. The graver raises a slight bur on the sides of the strokes; these must be removed by the dexterous use of the scraper, which must be prevented from removing any part of the general surface of the copper. The real breadth and direction of the strokes, may be seen by rubbing them with a roll of cloth containing oil; for the oil will sink into the strokes and give them a blackish appearance. It should be remembered, however, that whatever diminishes the sharpness of the edges of the strokes, will diminish the sharpness of the impression they will yield, and therefore the oil-cloth should be used gently, and as seldom as convenient. When broad strokes are required, they should be made of several strokes very close together, and cut till they are a little below the general surface of the copper. By this means the bottom of

the broad stroke will have a roughness which is necessary for it to retain the ink while cleaned by the printer, but it is no hinderance to the ink being taken up by the paper. If the broad strokes were produced at once, by the graver, their depth would be such as to overload the paper with ink.

Scratches and very slight imperfections of the strokes, may be rubbed out with the burnisher; those which are rather deeper, will require the scraper, and afterwards the burnisher; but to take out the deepest strokes, the copper must be hammered up on the back, and when the defective part is so much raised, that the false strokes will disappear by reducing it to the general level, it must be rubbed as in polishing a plate at first, and finished with a piece of soft charcoal.

When sculpture is represented, as it is always supposed to be white marble, or stone, the engraving should be light and smooth, the eye should have no pupil, and a certain degree of stiffness, or clotted appearance, must be given to the hair. Linen, should be represented by smaller, and closer lines, than other sorts of cloth, and by single strokes, except in some of the shades where it may occasionally be proper to have double strokes, to produce a good effect. Woollen cloth should have two strokes, and they ought to be fine or wide according to the supposed fineness or coarseness of its texture. In crossing the strokes, the second should be finer than the first.

Shining stuffs, such as silk or satin, require strokes which are harder and straighter that others; when their colours are bright, they are done with a single stroke; when dark, they require a double one; and the first strokes should be interlined by others, which are finer. Shining metals, glass, and smooth water, require clean single strokes, interlined by finer, except at the place of strongest reflection, where the strokes should be single. For smooth water, the strokes must be horizontal; in ruffled water, they must follow the course of the waves.

In representing mountains, the direction of the lines should be frequently interrupted, to shew the irregularities of the surface; but the greater the distance, the less of this should be perceived.

Dark clouds, greatly exercise the skill of the engraver, and generally require two strokes. Sometimes one set of the strokes are curved, and the other straight; sometimes both are curved; but in all cases, the intervals are more lozenge than for other objects. A serene sky, is represented by strokes parallel to the horizon, or by strokes following the same direction, but gently waved. According to the general rule for the sky, the strokes must be gradually stronger as they recede from the horizon.

In the lights of drapery, and other parts, where a few fine strokes are required, they should be put in with the dry-point, as that will be of the utmost importance.

The direct light of the sun falling upon copper, produces a glare which prevents the artist from properly seeing and executing his work. A screen is therefore employed, formed of tissue paper pasted upon a slight frame, which is placed in a sloping direction before

the window at which the artist sits, and the light he receives passes through it.

Even of those engravings which are considered as wholly executed by the tool, the dark shadows, and such objects as trees, are usually done by etching, to which we now proceed.

(TO BE CONTINUED.)

ENGLISH PATENTS.

To SAMUEL BAGSHAW, *of Newcastle-under-Line, in the County of Stafford, Gentleman, for his Invention of a new Method of Manufacturing Pipes for the Conveyance of Water and other Fluids. Sealed 8th August*, 1825.

His patent has two objects: first, to make pipes of clay, by a particular process; and, secondly, to unite those pipes, so as to form lengths of any indefinite extent.

In the first instance, cylindrical plugs of wood are provided, equal in diameter to the intended bore of the pipe, and of any suitable or convenient length; these plugs are to be coated on the outsides with soft clay, mixed up and laid on in the usual way of making pottery ware; a hollow cylindrical mould is then provided, consisting of two half cylinders, which when united and securely fastened together, form the mould for the outside of the intended pipe; the cylindrical wooden plug, with the clay surrounding it, is then passed through the hollow mould, and being squeezed hard, the superfluous matter becomes scraped off in its progress, and leaves the earthen pipe formed upon its plug. When this pipe has been dried, it may be readily drawn off the plug, and is then baked in the usual manner.

Two different sized pipes are thus to be made, the lesser pipes exactly fitted to pass freely through the inside of the larger. The lesser pipes being introduced into the larger, the space between them is to be filled with liquid cement of any kind, that is not subject to be affected by moisture, (Parker's cement is proposed,) and in thus uniting the pipes, care must be taken that the joints, or ends of the two inner pipes, are sufficiently covered by the outer pipes, for what is technically called, blocking the joints. Enrolled, October, 1825.

To WILLIAM WESTON YOUNG, *of Newton Nottage, in the County of Glamorgan, Engineer, for his Invention of certain Improvements in the Manufacture of Salt, part of which improvements are applicable to other useful purposes.*

There are two objects proposed under this patent; the first, is to place iron rafters and plates between the furnace, and the under side of the boiler in which the salt is to be evaporated, in order to prevent the immediate action of the fire against the boiler; which, in the ordinary construction of salt pans, and their fire-places, is very

apt to burn the salt, and thereby injure both its quality and colour; the second object, is to employ the steam evaporated from one salt pan, to the heating of another salt pan, placed above.

The plan proposed for the first object, is so extremely simple and evident, that drawings are not necessary to illustrate it. Iron bars, as rafters, are to be placed over the furnace, and upon these are to be laid iron plates, close beside each other, by which the immediate flame of the fire will be intercepted, and prevented from acting upon the boiler, though the heat absorbed by the iron will be sufficiently transmitted to the under side of the pan, to answer the purposes of evaporation.

The steam evolved from the pan, as the brine evaporates, is allowed to ascend in a confined chamber; and, to accomplish the second object of the invention, is to act against the under side of another salt pan, placed above. Enrolled, April, 1825.

It is rather extraordinary, that on the same day that this patent passed the Great Seal, a patent was also granted to William Furnival, of Anderton, in the county of Chester, for his invention of certain improvements in the manufacture of salt; and that the same object, viz.—causing the steam evolved from one salt pan, to rise in a confined chamber, for the purpose of heating another pan above, is contained in both specifications. In this case, neither of the patentees can be entitled to the exclusive use of the invention.

It is usual when two different parties are applying for patents having a similar object, that one or both of the parties takes out a caveat, to restrain the other from obtaining his patent, in which case the matter is referred to the Attorney or Solicitor-General, who receives both parties in his chambers, and hears them separately, and in private describe their plans. If their inventions are dissimilar, (of which he is to be the judge,) though having the same ulterior object, he allows both patents to proceed; but if they are considered to be alike, he refuses the petition of both, and stops the progress of the patent, unless they agree to become joint patentees of the same invention.

There is, however, no register preserved of the respective inventions; and, therefore, under these circumstances, it is impossible to compel a patentee to specify the same subject which he had described previously to receiving his patent. Hence there have been instances of persons explaining before the Attorney or Solicitor-General a subject as their invention, and after obtaining their patent, specifying something totally different, which they had invented or picked up in the interim. There does not appear to be any existing remedy for this evil; and we beg, respectfully, to propose the consideration of the subject in the proper quarter. [*Editor London Jour.*

To SAMUEL BROWN, *of Saville Row, Burlington Street, in the County of Middlesex, Commander in the Royal Navy, for his New Invented Apparatus for giving Motion to Vessels employed in inland Navigation. Sealed 15th March*, 1825.

The patentee proposes to lay a chain or rope along the bottom of the canal or river, and having made it fast at both ends, to impel the boats or other vessels along, by means of a wheel with indentations round its periphery, or a toothed or spur wheel, taking hold of the links of the chain.

The vessel containing the steam engine, or other moving agent, is to proceed first, and the other loaded boats or barges, are to be attached behind, in a train. At the bow, or the stern of the first boat, the indented or toothed wheel is to be placed, and the chain raised up by means of a grapple, and passed over the periphery of the wheel. Things being thus disposed, the engine is to cause the indented or toothed wheel to turn by means of a rigger and band, or any other well known contrivance, when the teeth or indentations of the wheel, taking into the links, or acting against the shoulders of the chain, the vessel is progressively drawn forward.

The periphery of the wheel may be variously formed; with cavities or indentations suited to hold the links; but it is proposed that its flanges or outer edges, shall spread, or be made bell shaped, in order to permit the chain to drop off freely, after it has passed the actuating points. The chain is intended to rise up from the water, at the fore part of the wheel, and after passing over the upper part of its periphery, to drop down behind the wheel into the water again, without passing into, or even touching the vessel.

The chain may be in one length, from end to end of the canal or river, or it may be in many lengths, extending only from lock to lock, or to the different turns or angles of the canal or river; and one line of chain is intended to be sufficient for conducting the boats or barges both to and fro. When the boats meet in opposite directions, the towing boat on one side may throw off the chain from its wheel, and take it on again, by means of a grapple, when the other train of boats have passed. Enrolled, July, 1825.

To JOHN FREDERICK SMITH, *of Dunstan Hall, in the Parish of Chesterfield, in the County of Derby, Esq. for his Invention of certain Improvements in the Preparation or Manufacture of Sliver, or Slivers, or Tops from Wool, or Wool and Cotton, or other suitable Fibrous Materials. Sealed 11th January*, 1825.

The operations of a carding engine, are to separate, comb out, and lay straight, the filaments of wool, cotton, or other fibrous materials that may be passed through it, and the fine thin sheet of filaments produced by the operation, is technically called *sliver*.

The patentee having observed that warmth facilitates the operation

of carding, (it having been practised for many years in combing wool,) proposes as a new invention, to heat the interior of the carding cylinder, by means of steam; and as wood is a bad conductor of heat, he proposes to make the carding cylinder of copper, which of course must be rendered steam-tight at the joints. Instead of setting the cards (wire brushes) in leather as usual, which would be soon destroyed by the heat, he proposes to fix the wires in block tin.

There are no particulars stated, as to the construction of the cylinder, except that the steam is to be introduced "through a hollow axis in the ordinary mode used by engineers for supplying steam in such situations with a waste pipe, to conduct away such parts of the steam as may be condensed." Enrolled July, 1825.

There have been, within the last two or three years, several patents granted for the employment of heat, in the preparation of wool, cotton, and silk; two of which patents have already been annulled by writs of *scire facias*, the principle having been long known, and in use.

Editor London Journal.

To James Hanmer Baker, *of the Island of Antigua, but now residing in St. Martin's Lane, in the county of Middlesex, Gentleman, for his Invention of certain Improvements in the Arts of Dying, and Calico Printing, by the use and application of certain Vegetable material or materials. Sealed 29th March,* 1825.

These improvements consist in employing the husk and shell of the cocoa-nut, or the leaves, branches, and indeed every part of the cocoa-nut tree, as a material from which a valuable dying matter may be extracted. The husk that encloses the nut and the footstalks of the leaves, are, however, to be preferred, both as being the cheapest, and most convenient for use.

The husks and stalks are to be thoroughly dried in the sun, but previously, it would be as well to slice them into thin pieces. The trunks and roots may also be split and dried.

If it should be found more desirable, for the sake of transportation, the colouring matter may be extracted from the woody parts, by making an infusion in hot water, and then evaporating the water, until the extract is brought to a paste, or to a dry state; care being taken that no vessel or article of iron, be employed in the operation. Reducing the material however in this way, is not to be recommended; as the colouring matter, by this process, undergoes some changes which considerably diminish its utility.

The cocoa-nut husk, or branches, or leaves of the tree, having been dried, are to be reduced to small pieces or powder, by crushing between rollers, grinding, rasping, or otherwise, and the colouring matter may then be extracted by infusion in hot or cold water, which may be assisted by the addition of lime, potash, ammonia, or other alkaline matters.

A wooden vat is to be filled with the materials, (husks or leaf stalks are to be preferred) and after covering the vat with a frame,

to keep the material from rising, the vat is to be filled with water, and allowed to remain in that state, for two or three days, according to the warmth of the weather, in which time the water will have acquired a yellowish brown tint. It is then to be drawn off by opening a cock at bottom, and a second and third charge of water poured upon it in the same way, until the colour of the extract is so pale, as to indicate that the material is spent. Another supply of the material is then necessary, and the same process is to be repeated.

With this extract, cotton, wool, hemp, flax, or silk, may be dyed a nankeen colour, by steeping in the liquor; the cotton, &c. having been previously cleansed and mordanted or not in the usual way, observing that none of the salts or preparations of iron are to be used. The mordant preferred for cotton goods, is a solution of pure alum, neutralized by chalk.

This infusion may be applied to printed goods, by having first covered those parts of a pattern intended to be white, with any of the mixtures commonly employed as a guard. The cloth being then steeped in the liquor, will receive the tint, and may be afterwards cleaned in the usual way.

The extract may be obtained by boiling the materials above mentioned, for an hour or more, in any suitable vessel, such as is commonly employed by dyers, (iron excepted.) While scalding hot, the liquor will dye goods by merely dipping them in, and drying immediately; but the durability of the colour is much increased, by previously passing the goods through an alum mordant. Another mode employed, is to dip the goods in, two or three times, drying them between, and then to raise the colour by a weak solution of muriate or nitro-muriate of tin, or nitrate of lead, or in oxymuriate of lime; after which, they must be immediately well rinsed in cold water, otherwise, the colour will be destroyed.

This dying material, contains, beside the colouring matter, a considerable quantity of the substances called tannin and gallic acid; the infusion therefore, whether prepared in the cold or hot way, will give with any of the salts of iron, a blue black colour, modified by the mordant. The salt of iron proposed to be employed, is the common iron liquor of dyers, made by dissolving iron in pyro-ligneous acid; and in this case, the extract from the cocoa-nut tree, made in hot water with lime, is to be preferred.

From the above extracts, by following the methods usually adopted by dyers, that is mixing astringent, yellow, and red colouring materials, olives, drabs, browns, grays, and a variety of other colours, of great beauty and durability, may be obtained; and in consequence of the quantity of tannin and gallic acid, contained in the cocoa-nut husk and leaf stalk, and indeed in every part of the tree, the infusion, whether a hot or cold extract, may be employed as a substitute for nut galls, or other astringent matter, in dying turkey red, and other colours.

The method of preparing infusions, or extracts and compounds for dyers, as above described, are not new; therefore form no part of the patentee's claims; but his invention consists solely in using

the "husk and shell of the cocoa-nut, as well as of the whole and every part of the cocoa-nut tree, as dying or tinging materials, in whatsoever way the same may be applied, or may be applicable to these purposes." Enrolled September, 1825.

Specification of the Patent granted to AARON JENNINS *and* JOHN BETTERIDGE, *both of Birmingham, in the county of Warwick, manufacturers and japanners in ordinary to his Majesty; for certain improvements in the method or methods of preparing and working Pearl-shell into various forms and devices, for the purpose of applying it to ornamental uses in the manufacture of Japan ware, and of other wares and articles, to which the same can be applied.* Patent dated March 29, 1825.

We the said Aaron Jennins and John Betteridge, do hereby declare, that the nature of our said invention, and the manner in which the same is to be performed, are particularly described and ascertained as follows, (that is to say) our said improvements in the method or methods of preparing and working of pearl-shell into various forms and devices, are, first, by reducing the shell by filing, grinding, rubbing, or other proper methods, into flat plates of about the fortieth part, or in some cases, the one hundredth part of an inch in thickness. We then draw, or pencil upon them with a hair pencil, the forms, shapes, or devices we wish to give the pieces of Pearl, either in a solution of asphaltum, made in the essential oil or spirit of turpentine, resin dissolved in the same menstruum, wax, varnish, or any fit and proper material, which is calculated to prevent the action of acids upon those parts of the pearl-shell so defended. When the coating thus laid on, is dry, we then brush over it repeatedly, strong nitrous, or other proper acids, until, by corrosion, the forms so drawn or etched, are left free. We then clear off or remove the asphaltum, resin, or other defence, by means of spirit of turpentine or other proper solvent, and the ornaments, sprigs, devices, or other figures are then fit for use.

We can, if necessary, coat or cover the whole surface or surfaces of the pearl-shell, with an etching ground, or other proper defensive varnish, or material, which will withstand the corrosive action of acids. We then draw, or trace with etching-needles, the forms or outlines of the devices, through the said etching ground, or other defensive varnish. Having thus drawn or etched the forms of any ornaments, sprigs, devices or figures upon the pearl-shell, we then brush over it repeatedly, strong nitrous or other proper acids, as above described. We can also, if required, pencil or draw with the asphaltum, or other proper defensive varnish, the forms or outlines of any parts of the surfaces of the thicker ornaments so freed, which we wish to relieve or leave prominent above the other parts of their surfaces; and we then brush over them, the nitrous or other proper acids, until the intended effect is produced.

After having reduced the pearl-shell into plates, of about the eightieth, or the one hundredth part of an inch in thickness, in the manner above described, we draw the outlines of any figures or ornaments upon them, and place them upon any flat, and smooth, hard surface, as iron-tinned plate, slate, marble, &c. We then, with a penknife, or proper cutting tools made on purpose, or sharp-pointed instruments, cut them out of the pearl-shell for use.

Lastly, when we wish to produce a number of figures, ornaments, or devices, all of a uniform shape and size, we take from six to twelve of the plates of pearl-shell, of about the eightieth or the one hundredth part of an inch in thickness, and we unite or combine them closely together, by means of glue, gum, or other cement, into one mass; when dry and firm, we draw the outlines of the figures, ornaments, or devices upon one of the outer pieces, and holding the mass in a vice, or by other proper means, we, by the aid of files, drills, saws, or other proper tools or instruments, shape the mass into the required form; this done, by means of water, turpentine, alcohol, or other proper solvent, we dissolve the glue, gum, or cement, and the pieces become separated and fit for use.

By thus substituting *the free use of the artist's pencil* for the files, saws, and other tools, ordinarily employed in shaping this *brittle material* into form, *a degree of freedom and elegance is introduced into the pearl ornamental designs produced thereby*, of which we have never before seen any examples, the produce of this country; and we have no doubt that the employment of pearl in this way, will be very extensive in the arts. [*Editor Tech. Rep.*

Specification of the Patent granted to WILLIAM WHEATSTONE, *Music-seller, for a method of improving and augmenting the tones of Piano-Fortes, Organs, and Euphonons.—Dated July* 29, 1824.

I, the said William Wheatstone, do hereby declare, that the nature of my said invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the following specification thereof; (that is to say) my said invention, or method of improving and augmenting the tones of Piano-Fortes, Organs, and Euphonons, consists in covering as much of their external surfaces as possible, with frames formed either of wood, or other fit and proper materials, and having bars across them to strengthen or connect them together. These said frames are to be covered on both sides with thin, elastic, flexible, vibrating substances, tightly stretched over them; such as vellum, parchment, or other animal membranes, paper, canvas, woven-silk, linen, or any other fit and proper substances, or combinations thereof. These said frames are to be placed as nearly as possible to the strings of the Piano-Fortes and Euphonons, or to the pipes of Organs, in order that the interior flexible substances they are covered with, may receive the vibrations from the strings or

pipes when sounded, aided by the sound-boards; and, by reverberating them between the two flexible surfaces, and through the agency of the columns of air therein interposed, greatly improve the quality of the tones produced from the instruments, and communicate them, thus improved, through the exterior flexible vibrating surfaces, to the auditor. Thicker or thinner flexible vibrating substances may be employed to cover the frames with, according to the nature or quality of the tones ordinarily produced by the instruments; for instance, in those instruments which have lesser powers of producing tones than others, or where more power is required from the instruments, I would employ thinner vibrating substances, than in those cases where the tones of the instruments are too loud and harsh, and require thicker vibrating substances to ameliorate them. I also, occasionally, cause holes to be made, either directly through the outsides of the frames, to their interiors, or else communicating with other holes, at right-angles to them, reaching from the interior of the frames; and which said holes convey the tones from between the flexible vibrating surfaces to the external air, with additional effect. I also furnish the exterior of these holes with trumpet-mouthed tubes, about an inch in length, or longer; or else cover them with hollow trunks or tubes, communicating with several of the holes; and which said tubes have convenient orifices, at their ends, sides, or fronts, opening to the external air. In some instances it may be also desirable, for the purposes before mentioned, to form other holes, in the insides of the frames, communicating with their interiors: similar to those above mentioned, as proceeding from their outsides.

MECHANICAL JURISPRUDENCE.—No. 7.

BY PETER A. BROWNE, ESQ.

On the Law of Patents, for New and Useful Inventions.

When an application is made at the office of the Secretary of State, for a patent, no judicial investigation takes place into the qualifications of the patentee. Any one who will make the necessary oath, will comply with the *formal* requisites of the act of Congress, and will pay the very small sum of $30, into the Public Treasury, can obtain letters patent, signed by the President, and sealed with the seal of the United States; and the validity of his claim to an exclusive privilege, if disputed, depends upon circumstances, which may be enquired into, in a subsequent judicial examination. To any one who is made acquainted with the facility with which letters are thus obtained, it will not be a matter of surprise, that unworthy persons take advantage of a law, made to protect the deserving. Instances are on record, of some patents taken out for things not embraced by the act; and others, by persons who had no shadow of title to the invention. To detect and punish these imposters, the public must possess at least, a general knowledge of the law of patent rights, and this

knowledge it is proposed to diffuse by means of these essays. But if it is important to the public in general, to acquire a knowledge of the patent law, much more so is it to the *ingenious mechanic*. Experience has shown, that it is to this valuable class of the community, that the world is indebted for many of the most useful improvements in the arts; and it is distressing to reflect, that when one of them shall have laboured for years, in projecting a new invention, and expended his hard earnings in making the necessary experiments, that all his hopes shall be blasted, for want of as much knowledge of the laws of his country, as can be acquired in a few hours reading. Perhaps it may be said that he can obtain all this information at a small expense, from the professional gentleman, to whom he will apply to draw up his specification; but let it be remembered, that in many instances, this knowledge may *then* come too late; he will not apply to counsel until he is ready to take out his patent, and the chances are, that long before that period shall have arrived, by some inadvertent act, he may have made his discovery public, or in some other way have forfeited his right to a patent; after which, he can never claim the exclusive privilege of using his own invention.

That the subject is *fertile*, will at once be perceived: a proper discussion of it, will necessarily involve the following topics, viz:

An inquiry into the requisites in order to obtain a valid patent.
The proceedings to obtain a patent.
The benefits, privileges, and remedies of a patentee.
The methods of *contesting* a patent claim.
The whole will be occasionally interspersed with such advice to patentees, as reading or experience has suggested.

With respect to the intricacy of the subject, it is necessary to observe that in discussing the patent law of the United States, I shall be led to take considerable notice of the laws of England on the same subject. This course will be found to be indispensable; the laws of the two countries are so interwoven together, that a perfect understanding of the former, is much aided by a general knowledge of the latter; and when we consider how many ingenious American citizens, have taken out, and are daily taking out, patents in England, no one will, I trust, consider the time lost, which is employed in examining the patent law of that country.

The laws of England, with respect to patent rights, are to be studied in the common law, the statute of 21st James the first, and numerous adjudged cases. These cases are to be sought for, in hundreds of volumes of English reports, now extant; and when found, they are, some of them, contradictory, many, obscure and difficult to be understood, and the whole, devoid of all methodical arrangement. The student has not in *this* branch of the law, as in some others, the advantage of consulting any well written elementary treatise. Almost the whole of Mr. Davis's book on patents, is occupied with cases, extracted and copied verbatim from the English books of reports, and inserted without regard to any thing, but chronological order; and the remaining part, (except the introduction) containing what he calls his *practical observations*, is ill digested, and devoid of arrangement.

From this chaos, to call forth a system, is a task requiring labour and perseverance.

Upon the British stock, has been engrafted the American scion, which will be found in the Constitution of the United States, the acts of congress, and the numerous and highly interesting decisions that have taken place since 1793, in the several District Courts, in the Circuit Courts, and in the Supreme Court of the United States.

Judge Washington, in the case of Pettibone *v.* Derringer, M. S. rep. C. C. U. S. Penna. District, pronounced controversies concerning patent rights, to be the most difficult that are presented to courts and juries; and Judge Story, in the case of Barrett *v.* Hall, 1 Mason's rep. 472, declared that the doctrine of patents, in truth, constitutes the *metaphysics* of the law. It surely becomes me to approach with diffidence, and to discuss with caution, a subject, considered so profound and so intricate, by those two great American legal luminaries.

When we contemplate the wonderful improvements that have taken place, within the last half century, in manufactures and the useful arts, and when we consider the happy effects that these improvements have had upon the condition of the human race, we are inclined to think that a brief history of the rise and progress of the law of patent rights, upon which these improvements are founded, and with the aid of which they have flourished, will not only prove amusing, but highly interesting and instructive; and particularly so, to the citizens of this republic.

Upon taking a comparative view of the new and useful inventions and discoveries that have been made *prior*, and *subsequent*, to the passage of the patent act, we are led to the opinion, that that statute has been a powerful incentive to genius and industry; and this idea has been strongly corroborated by the additional consideration, that in the same proportion as the patent law has been understood, and the rights of the patentees been secured and established, has been the *increase* in the usefulness as well as in the number of these discoveries. The principal part of the British decisions upon patents, have taken place within the last half century; and do we not all know that *that* period has been eminently distinguished, by the most brilliant inventions?

Mankind have always considered themselves under an obligation to those, by the force of whose genius, or intense application, some new and useful discovery has been made; but the degree of respect which has been shown them, and the nature of their remuneration, have been different, in different countries, and at different times.

Some of the ancients, paid them divine honours. Athens was particularly famous for her knowledge of the arts, and her manufactures of all sorts, were in high repute; the reason was, that emulation was excited by the *public rewards*, and *honours*, which were bestowed upon those who attained to excellence, in any of the useful arts.

Of all the methods devised to compensate the inventors of new and useful improvements, that, by granting them an exclusive right to use their own inventions, for a limited time, is the most *just* and *equitable*.

It is a payment *in kind;* graduated by the degree of usefulness of the invention. If the discovery is but of *small* advantage to the community, let no one envy the inventor the exclusive use of it, for fourteen years; for his compensation will be *proportionably small;* and if the exclusive use of the invention for that period, is likely, in another case, to be *immensely profitable*, let it be recollected, that it can be so only upon the principle, that the discovery will afterwards, be of *immense advantage to the public.*

An Essay on the Bombyx Mori, or Silk Worm, read before the Maclurean Lyceum of Science of Philadelphia, June 11th, 1826, by JOHN T. SHARPLESS, M. D.

As this small, but interesting animal, has began to attract the attention of all ranks of society in our country, from the ruler to the peasant, and as a particular and useful knowledge, is confined to few, I have been induced to collect what is known upon the subject, to deliver before you, not for the purpose of satisfying, but exciting curiosity; in hopes a desire for further knowledge, may induce you to study this useful being, for yourselves.

The Silk Worm is generally supposed to be a native of China, though it has been asserted, that it was introduced there by the Jews, from India, about the conquest of Alexander. There is, however, in the annals of that country, mention made of articles of silk, 780 years B. C. but it is unknown, if of this particular animal, or of another similar. The use of this article, was introduced into Greece and Rome, through Persia. It was, however, so extremely expensive, that it sold for its weight of gold, and the Emperor Aurelian, is said to have refused his wife a dress, from its dearness. This great price was caused by the immense distance to be travelled from China to Syria, caravans being 243 days on the road. Virgil and Horace are the first Roman writers who mention it, and they supposed it to be a kind of down found on leaves. It was also thought to be a sort of wool or cotton, or the production of a species of worm, which they called ser, and the silk sericum. The Emperor Justinian, anxious to introduce the worm itself among his subjects, made many fruitless attempts, by negociation, but accident produced what power could not. Two Christian Missionaries, in their wanderings over Asia, about the year 555, stole into China, concealed some of the eggs in the hollow of a cane, and brought them to Constantinople. The animal was soon distributed over the Mediterranean, Sicily and Italy, in particular, and about the year 1600, was introduced into England. They had, however, been familiar with silk a long time before, but it was so expensive, that James first, of Scotland, had to borrow a pair of silk stockings of the Earl of Mar, to appear before the English Ambassador, using this irresistible persuasion. "Ye would not sure, that your king appear as a scrub before strangers."

About the year 1770, it began to attract attention, in the then British colonies, and under the particular patronage of Dr. Franklin. By his exertions, a society was established and incorporated, by the name of The Filature of Philadelphia. Large quantities of silk were raised, and sent to England, for manufacture. Premiums were offered of £15 for the greatest number, not less than thirty thousand, and £10 for not less than twenty thousand cocoons. They also gave 25 per cent. more than they could be sold for, in other parts of the provinces.

There are still many articles in use in Chester County, the silk of which, was raised under the British Government. The revolutionary war, however, interrupted its cultivation, but within the last four years, a disposition to resume it, has prevailed to a very considerable extent, and it is hoped, may continue, till silk will become one of the staples of our country. This revival has been produced, in a great measure, by the praise worthy exertions of Mr. Samuel Alexander, of this city. A number of eggs were brought by him, a few years since from Gibraltar, from a very laudable curiosity to observe the peculiar habits of the animal. He was soon struck with the probable advantage the country might derive from its propagation, and by indefatigable perseverance and industry, he has produced and distributed about five millions of eggs; most of the worms in and near the city, are the production of his Gibraltar eggs. He has, however, lately received some of the best Italian eggs, which will probably improve the breed. It was also through this gentleman, that Mr. Miner was induced to bring forward his motion in Congress, to investigate the matter. Such exertions for his country's good, deserve the applause of the world, and the gratitude of his fellow citizens.

Dr. Mease also imported a quantity of eggs from Genoa, which were deposited, and the worms are now thriving at the Hospital.

There are at this time, about five hundred thousand animals in Philadelphia and its vicinity. The largest collections I am acquainted with, are those of the Hospital, twenty-five thousand, Mr. Alexander, Mr. Dusar and Mrs. Kempton, each ten thousand. There are also some others, I have not visited. Mr. Dusar, who became interested in the subject through Mr. Alexander, has sent to Europe, for books, eggs and the finest kind of mulberry trees. He has already, a large quantity of trees, and purposes prosecuting the subject, till a regular establishment is founded. Those who wish more practical information, should call on either of those gentlemen, who are very obliging in distributing eggs, and communicating knowledge.

The silk worm belongs to the great division of entomology, Lepedoptera, Genus Phalina, and Sub Genus Bombyx, Species Mori, from its food. As it is not intended to give a technical description of the genus and species, I shall pass on to that kind of matter, that is more immediately useful. It belongs, however, to the same genus as our moths and butterflies, but differing from some of them in remaining in the egg during the winter, whilst others spend the cold season in the cocoon. It also differs from the butterflies in not flying in its wild state in the day, always waiting for the evening. In

China this animal is found wild, and producing, without any trouble, large quantities of silk, but cultivation has a happy effect, even in its native country, the finest silk by far, being the production of the sheltered worm. Of all the European countries, Spain produces the finest insect, hence, even the French and Italians are compelled to renew their breeds from that country, every few years. Through all parts of the world, this little being follows the same course in its changes, and in nearly the same time. It can, however, be forced to go through its metamorphoses more rapidly, by very frequent feeding. Instead of 40 or 45 days required from birth to the cocoon, they are in China, forced to complete their changes in 25. They have also, in in this state, commenced spinning in 26 days.

The changes this useful creature undergoes are really astonishing. Spending its winter in the ovum or egg, a nearly shapeless mass, on the approach of warm weather it bursts from its thraldom, and appears an animal much like a small black ant. His increase of size is very rapid. In eight days, he has increased from the sixteenth, to one-fourth of an inch in length. He now becomes still, ceases to eat, raises his head some distance from the surface, folds his feet together, and looks much as if in the act of supplication. He begins to wriggle his body, and labour apparently in pain, but his skin soon becomes broken in the back, and he slips out of it, of a yellow colour. The covering to his head separates in a distinct piece. This process is generally accomplished in 36 hours. In a short time he begins to eat again, and grows more rapidly than before, attaining in five days more the length of half an inch, and then again goes through the same process of skinning himself. In another five days, he is more than one inch in length, and again undergoes the process of cutaneous deprivation. In another five days he makes his fourth change of garment, and soon after, arrives at his full size of three inches. He now eats voraciously, till within a few hours of his spinning, when he becomes translucent, wanders about examining the premises, and leaving silky traces on his path. He commences this process by fixing on some corner or spot where he can form a hollow space for his habitation. He attaches his thread from side to side, though several inches may intervene, not following the radiated style of the spider, but seeking to strengthen his scaffolding by every means in his power. These long threads are crossed in every direction, rapidly approaching the centre of the enclosed cavity, till it surrounds a space about the size and shape of a pigeon's egg, when they become more compact, the filaments being placed in close contact, and shutting out the air, and light. The motion of his mouth, is now that of the figure 8. In 24 hours he can no longer be seen, though his labours may yet be detected by the ear. As the spinning process goes on, the contents of his body diminishing, he rapidly contracts in size, and in five or six days, he has completed his cocoon. He now appears about an inch in length, his skin dry and shrivelled. In about twenty-four hours after he has terminated building, his skin becomes loose, opens in the back, and slips off him, leaving him without feet, the shape of his system changed, and with the rudiments of wings and

antennæ. In 15 days from the commencement of spinning, the skin, covering the head of this aurelia, or chrysalis, opens, and it emits a liquor which softens, and weakens the threads, at the end of the cocoon. I have not been able to ascertain, positively, whether he really gnaws the filaments, or merely breaks them after their texture is destroyed; according to Mr. Swayne, he only separates them from each other; but a hole soon appears, through which a full grown, white moth issues, leaving a hard, brown case behind. Both males and females, now discharge a reddish fluid from their tails, and the sexual intercourse commences; this continues twenty-four hours, when the female begins the last process of her existence; depositing her eggs upon any substance that falls in her way, generally laying from two to five hundred, and having performed this office, dies a short time afterwards. If no intercourse should take place between the sexes, a number of eggs may still be produced, but they are barren. Upon opening a very strong cocoon a few days since, I found a fly actually ovipositing, within the case that it leaves in the ball. The animal was much diseased, and unable to make its way out, and had commenced the deposition of these unimpregnated eggs within the cocoon. The eggs remain dormant till the following spring, when they follow the same round of change as their ancestors.

The external appearance of this curious creature is now so well known, that I shall pass on to a general description of its internal anatomy, as described by Malpighi and Blumenbach. In the larva or worm, there is a straight hollow tube, extending from the mouth to the anus, which is its stomach, and intestines; also a double vessel, much convoluted, about one foot in length, containing the gum, which afterwards becomes the silk. This gum-vessel extends very low down in the body, and terminates, by an orifice, at its anterior extremity, in a papilla on the lower lip. The gum contained in this vessel assumes, towards the spinning time, the particular colour the silk will have, is extremely tenacious, and dries into a hard insoluble mass; and if a thread be drawn out much thicker than silk, when dry, it will break like glass. The *respiratory* apparatus consists of nine dark points on each side, called *Stigmati*. From these extend tubes, terminating in a large air vessel on each side, called *Trachæ*, running the length of the body, and from which innumerable ramifications pass all over it, coming in contact with the extremities of whatever vessels carry on nutrition. What these nutrition vessels are, have not been ascertained. Baron Cuvier considers them mere imbibing tubes, that deposit what they absorb from the stomach. The *circulating* arrangement is equally little understood, the contracting and dilating vessel on the back, being supposed by Malpighi, to be a succession of hearts, receiving fluids absorbed from the stomach, and distributing them round the system, but never returning; whilst Lyonet could find neither entering nor salient vessels, and supposed, therefore, it carried on some secreting power now unknown. The whole worm, however, seems a mere mass of vessels, containing a green or yellow fluid, answering the purpose of blood, but how produced or propelled, is, I believe, also unknown.

In the Imago or Fly, the circulating and respiratory apparatus remain nearly as in the worm, whilst the digestive machinery has almost disappeared, now answering no apparent purpose. In some of the Lepidoptera, the Papillio or Butterfly, for instance, the stomach is kept in slight operation by the honey of flowers that it sips, but I cannot discover that the moth tribe eat at all—the whole space once occupied by stomach and intestines, being now filled by the ova, or other requisites for continuing the species.

The time the egg should be hatched, depends on the vegetation of the mulberry. It is usual and correct to keep the eggs in a cool, dry place, till the leaves are the size of a dime. It is also recommended to keep half the eggs, until it is impossible that a frost can blight the leaf, and the worms starve; but if the leaves have arrived at that size, there is little danger of an accident of this kind. The eggs may even be kept in an ice-house, if the warm weather threaten to bring them forward too rapidly; neither is there any danger from an exposure of them to cold, for Spallanzani placed them in a temperature of 38° below zero, without injury. It has been recommended by some writers, to steep the eggs in weak wine and water, one fourth of an hour, just before you expect them to hatch, and the "breed will be much improved, producing a stronger worm." When the season arrives for the hatching, which is generally the beginning of May, they should be brought into a warm place, as in the sun, and in a few days they will burst the egg. In Europe, persons sometimes carry the egg about, near the skin, to bring them forward, but the heat of the sun, or of a warm room, answers the purpose. In China, a fire of the dried dung of Cows, is considered the best. L'Abbé Boissier recommends a fire of well dried tanner's bark, turf, or sea-coal, as burning slowly, and giving a regular heat. You may know when they are near hatching by their changing colour, from a dark purple, to a pale blue. When large numbers are raised, the eggs, at the time of hatching, are spread out on a board in layers of not more than half an inch thick, and a wicker or net frame, or, a sheet of white paper, pricked full of large pin holes, placed above them, but in contact, with leaves upon it. The worms, as they are hatched, crawl through the openings, and must be removed as their numbers increase; this is necessary, as the worms, on immerging, spin a fine silk over every thing that they touch, which often fastens many together. They should be kept on sheets of paper till they have passed their second moulting, and then be removed to an apparatus, which saves a vast deal of labour; this has four upright posts, to form a frame of not more than five or six feet in length, and about thirty inches deep; cleets are placed, about twelve inches apart, on which moveable frames, with wire middles, slide; a drawer is placed about two inches under each shelf, to receive what falls through the wires; this must be removed and cleaned every day. The apertures between the wires must be proportioned to the size of the worm. The distance between the drawer, and shelf, must not be so great that the worm cannot get up again, if he should happen to fall through. This apparatus is now used by Messrs. Alexander and Dusar. The insect now requires fresh air,

which must be freely admitted; care must also be taken to keep out other animals; Mr. Dusar places, for this purpose, wire netting before his windows. An old work, printed in 1653, on the cultivation of the Bombyx in Virginia, recommends that occasionally you should burn in the room some "Juniper and other herbs that give good smells," and also have scented flowers always in the room. If, on the appearance of the worm, any cause prevent you from obtaining the white mulberry, you must employ lettuce or salad; I shall speak, however, more particularly of their food, in a succeeding part of this essay. It is absolutely necessary that their food, whatever it may be, should be perfectly free from dampness, as this will destroy the animal. I have been unable to ascertain if the sheltered China worm is equally affected by moisture; the wild animal is certainly accustomed to it. In China, the worms are fed forty-eight times, the first twenty-four hours; the second, thirty, and each day the number is decreased; but even at the close they are fed six times, regularly, every day. This greatly diminishes the time occupied by the animal in its different metamorphoses. They ought certainly to receive fresh young leaves every four hours, for the first two or three days, and the frequency may be then diminished, and towards the spinning, twice a day is often enough. It is more economical, whilst the worms are young, to cut the leaves up into pieces, the size of a cent. Until they are placed upon the frames, they should be separated from the dry leaves and excrement, every day, having a very natural dislike to living among their own ordure. This can be conveniently done by sweeping the old leaves on which the worms are sticking, into a row, and placing parallel to this, and within half an inch, a second row of fresh leaves. They soon smell the new food, and leave the old, which may, in fifteen minutes, be removed. In China, before feeding them, they dry off what moisture may have collected, by passing a whisk of burning straw over them, or place them a few minutes in the sun. The animal at this time, as also whilst in the egg, must be preserved from other insects, or vermin. The Larva, or worm, is subject to disease that must be attended to. By bad diet or exposure, they become indolent, cease eating, the skin becomes relaxed, and the colour changed: there is now, according to L'Abbé Sauvage, but one remedy, and that is the cold-bath: they should be thrown by handfulls into cold water, for a minute or two, and then replaced on their shelf. If they seem languid and contracted afterward, a little heat will soon revive them. In Georgia they burn brown sugar as a remedy.

When the time arrives for spinning, the excrement that was perfectly black, and shaped like a mulberry, now assumes a loose texture, of a greenish hue, and resembles very finely powdered leaves. It appears as though nature had perfected the animal, and the powers of digestion must cease, and the food pass through unaffected. This, however, is not altogether the case, for it is partly soluble in water, and produces a dye of a green colour. Mr. S. Alexander ground it with oil, and made a pigment. After the discharge of this substance, a glairy, transparent fluid follows as a closing operation, and every process, except spinning, apparently ceases.

To facilitate this undertaking, has been a subject of enquiry for a long time, and many experiments have been made to compel them to *ramer*, as the French call it, or climb. If the weather is very warm, they will not ascend, but seem exhausted, spinning their silk on every substance they touch. To induce them to mount, the Italians carry into the room a smoaking hot cake, made of onions and eggs, when they seem revived, instantly. In Georgia they rub the shelves with fennel for this purpose. The smoke of tobacco is extremely disagreeable, and will prevent their spinning.

They have also some choice in the articles to which to attach their ball; in Georgia, rows of oak bushes that have been drying for several days, with their leaves, are stuck upright in rows near the worm. Mr. Alexander also, believes them to be next in goodness to the bamboo, which is used entirely in India, and is, undoubtedly, the best article. The bamboo, is used with is branches attached, or is split, and plaited into little cells or boxes. They will also spin in small paper cones, or in wine glasses, but on a large scale this is too troublesome.

We shall find, however, notwithstanding all our trouble, some worms which will not mount or spin a regular cocoon, but wander about as if attending to every body's business but their own. They will be constantly spinning, but it will be on their neighbours' territories, fastening the houses of others together, and doing mischief by that means; or they will work indefatigably on a flat surface, forming a pretty exhibition of the spinning process, but not for their own benefit, as they can make no cocoon. These larvæ, however, follow the same course as the others in their metamorphoses, and form a fly in a regular manner.

As the little being has no sex before encasing itself, it requires some experience to detect the two sexes whilst in the cocoon, for the purpose of laying by, for seed. An equal number of each, should be selected. Pullein says the male cocoon may be known by being more pointed, and smaller, the female being regularly oblong and larger. In the Genoa worm this description entirely fails, as no possible difference can be detected. In this selection you should choose the earliest spun, largest, firmest, deepest coloured balls. It is recommended to run a thread through the loose silk of the chosen balls, and to hang them up in the free air.

When the Moth makes its appearance, its wings are compressed, but they soon expand and perform their proper office. The male is now known by his greater activity, being always in motion, and by his darker coloured wings, and smaller body. The female has a large pendulous belly. The flies may now be placed in contact, on a rough cloth.

The eggs, when first emitted, are of a yellow colour, but in three or four days become of a bluish ash colour, and flattened, or slightly indented. The eggs that do not change colour, are unimpregnated, and, therefore barren, and should be thrown away.

The number of insects to keep for breed is easily calculated. Two hundred flies of each sex producing an ounce of eggs, which is about forty-five thousand. In China, the eggs are deposited on sheets of

paper, which are hung up in the air to dry, far removed from any hempen rope, as this, they say, destroys both the eggs and worms of some size. About the last of December they are put into cold water, in which has been dissolved a little salt, or weak mulberry-tree lye, or are hung up in the rain. They are then loosely rolled up and placed in a dry situation. All the care necessary in our own climate, is to expose them to the air a short time, then wrap them up loosely and put them in a dry place. In Italy, they dip the cloths on which they are deposited, into wine and water, which softens the agglutinating substance, when they are carefully scraped off and placed in a box.

As there is generally a crop of eggs by the last of June, it has been a subject of inquiry, if two profitable crops of cocoons could not be raised in a season. In Romagna, and La Marche de Ancona, they regularly have two Racoltas or Harvests. They keep the eggs cool till the leaves shoot out afresh, which generally takes place in September; and if the worms appear before that time, they are fed on rose leaves, lettuce, etc. The mulberry can also be forced in a degree, by putting branches in warm water. The cocoons of this second crop, are much inferior to the first: this has failed entirely, both in France and in this country. In extremely warm parts of the world, Bengal and the Isle of France for instance, this second, or even a third hatching cannot be prevented; for according to Dr. Anderson, "the time necessary to go through all the evolutions, is forty-five days from the egg to the death." That is to say, they are six days an egg, twenty-two a worm, eleven in the cocoon, and one a moth. In our own country, they are generally forty-two days in the larvæ state, sixteen in the cocoon, and two, as an imago or fly; making sixty days as a perfect life time. This however is not universal, for in the hospital of this city, the average life of the larvæ was but twenty-six days.

(TO BE CONTINUED.)

FOR THE FRANKLIN JOURNAL.

On an Economical Mill, for Grinding Grain, to be worked by horse or ox power.

TO THE FARMERS AND PLANTERS OF THE UNITED STATES.

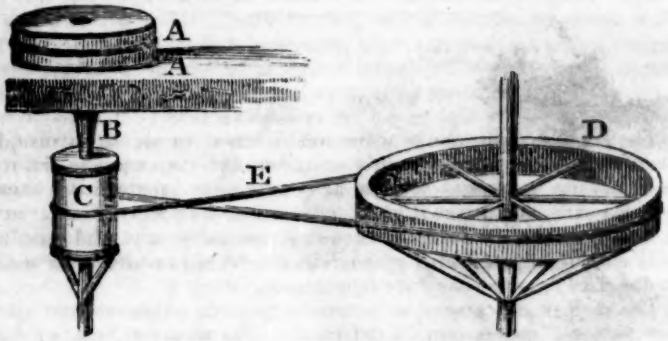
A large portion of the farmers, and others, living in all parts of the United States, have, from the earliest period of its settlement, to the present day, suffered much inconvenience, and had their comfort and prosperity greatly abridged, in consequence of the great distance of their dwellings from grist-mills; and the frequent summer droughts of late years, have caused the evil to be more extensively felt.

Good mills are now very general, yet thousands of us are settled at such a distance from them, or see those in our neighbourhood useless from want of water, during a large portion of the year; that the labour of carrying grain to the mill, is frequently greater than would be necessary to grind it, were a mill constructed, that could be worked with facility by a horse, or an ox. In such a mill, the very

animal which is now employed to carry the grain, and wait for, and return with the flour, might sometimes grind ten times the quantity in the time which is necessarily lost.

Various plans for making cheap and simple mills, have been proposed, but from their not getting into general use, it is to be presumed that they have not been found to answer the purpose. The writer feels confident that the objections which have existed to those which have been heretofore erected, will be completely obviated by the plan which he is about to propose. He is aware that economy is a point of the first importance; the mill which is here described, will cost much less than those which have been heretofore erected for a similar purpose; its construction is very simple, and the common country carpenter and smith, will find no difficulty in completing it.

The plan it is believed is new, and that it is effectual, has been fully ascertained, as the writer has a mill of the description, now at work. The subjoined sketch, will give a sufficient idea of those parts which it is necessary to describe.



AA, are the mill-stones.

B, the spindle which supports the upper stone.

C, a drum, upon the spindle, made long, to prevent the belt from running off.

D, a large gin, with its shaft and arms; the lever to which the horse is to be yoked, is not represented.

E, the belt of tanned leather, five or six inches broad, with a buckle, to give it the necessary tightness.

It has not been thought requisite to represent the hopper, and other necessary appendages, as with these every country mechanic is sufficiently acquainted.

The larger the circle in which an animal draws, the greater will be his power. Less than eighteen feet will not answer, but twenty-four feet will probably be found in most instances to be more suitable. If a horse make three turns in a minute, in a circle of this size, he will travel at the rate of about two and a half miles in an hour. Then if the diameter of the gin, or large drum, be to that upon the spindle, as forty to one, the stone will make one hundred and twenty revolu-

tions in a minute. In this case, the gin may be thirty feet, and the small drum, nine inches in diameter; but it will probably be better to allow one foot for the drum, which will give to the stone, ninety revolutions, the track of the horse remaining as before; it is evident, however, that if this track is made smaller, the horse, travelling at the same rate, will give greater velocity to the stone.

There are several advantages in making the belt wide, as it takes a firmer hold, is less subject to stretch, and less apt to slip off.

In different diameters of the stones, and other changes, the whole must of course be so modified as to suit them, but this can be done by any man of common understanding. It will always be best to place the whole under cover, not only to preserve the wood work, but to enable the farmer to work in wet weather; the belt, if wet, would stretch, and not turn the stones. It will probably be found best, in most cases, to place the stones, hopper, &c. in the corner of a barn, or other suitable building, with the gin on the outside, and the strap passing through holes made for the purpose. S.

ON JAPANNING AND VARNISHING, No. I.

BY THE EDITOR.

The art of making, and of using, the different species of varnish, is one of high importance, not only on account of the exquisite beauty of an infinite number of articles upon which the japanner has exercised his skill, but also as it contributes to the durability of a variety of materials used in domestic economy, and in the arts, and enables us to employ others, which without its aid, would be altogether unfit for the uses to which they are now appropriated.

The recipes and processes generally given in works written upon this subject, are extremely defective. The common practice has been, to copy from book to book, the false or imperfect accounts which were at first published by persons who were without practical knowledge, and who had in many instances obtained them from those who were interested in keeping some material part, secret. In general, when the recipes are good, the directions are so brief, as to be altogether useless to those who are not already practised in the art; or at least, so incomplete, as to occasion many failures in the attempt to put them into practice. In the midst of the mass of rubbish which has been accumulated in the "*Thousand valuable Secrets*," "*Guides*," "*Instructers*," and a variety of other books, which have at various times issued from the press, there is a portion of valuable matter, which ought to be collected, and methodized. In many of the philosophical, and other journals, both foreign and domestic, much is contained, which from its isolated situation is of little general utility, being rarely accessible to the practical man. From these sources, it is intended to obtain whatever is worth preservation, and to present it in a form as clear, distinct, and practical, as possible. Precise directions will be given for preparing, using, and polishing, the different

kinds of varnish. In accomplishing this, the editor is aware that he must sometimes enter into a minuteness of detail, which to the initiated may appear tiresome; but it must be recollected, that he does not expect to instruct persons of this class; as respects them his most ardent wish is to obtain their aid in the accomplishment of his purpose. In order to teach well, we must suppose the learner entirely ignorant of the subject in hand; and request those who are not so situated, to recollect the period when a similar course would have been welcome to themselves.

The editor has been in the habit of making, and of using a variety of varnishes, and can therefore draw upon his own resources to a considerable extent, but he is not dependant upon these alone, for original information. Mr. John Meer, a gentleman well known in this city, who has been, for more than half a century, in the habit of manufacturing and using almost every kind employed, both for coarse and fine purposes, has promised his aid in the prosecution of this undertaking. Whatever these numbers may contain, may be considered, therefore, as perfectly correct, being the result of actual experience.

The materials used in varnishes are numerous, but they all consist of some solid substance, dissolved by the aid of a liquid. Sometimes, though rarely, the two are found in nature, combined together, so as to furnish a native varnish; that most celebrated among the Chinese, and Japanese, is said to be of this description. The solids which enter into the composition of varnishes, are those generally known under the name of gums, and resins. There is, however, considerable confusion in the names given to these substances, several of them properly belonging to the class of resins, being denominated gums; thus we have gum copal, gum animi, and a variety of others, which are improperly so called. Their distinctive characters we shall presently examine.

The *menstruums*, or fluids, used to dissolve the solids, are not numerous. Water, alcohol, ether, some of the fixed, and of the volatile oils, constitute the list. The purity of these articles, is, in many instances, a point of considerable importance, and we shall, in the course of our investigations, pay particular attention to this part of our subject.

The term Japan is used to designate those varnishes, which give to articles an appearance similar to those which are imported from Japan, and other parts of India. The name of Japan varnish, is frequently appropriated, exclusively, to that species of oil varnish, which is used upon waiters, and many other articles, and which is dried by the heat of a stove, constructed for the purpose.

Gums are the inspissated juices of certain vegetables, before the gum is dried, or after being dried, if it be dissolved in water, the solution is called *mucilage*. The gums, properly so called, are soluble in water, whilst the resins are entirely insoluble in that fluid; gums are insoluble in alcohol, remaining unchanged in it for any length of time; and indeed they may be precipitated after having been dissolved in water, by pouring alcohol into the solution. The species of gum most extensively used, is gum arabic, or senegal; that which exudes

from plum, peach, and other trees, possesses similar properties. Gum water may be considered as the most simple of the varnishes; it is sometimes used on pictures, and on painted toys, to give them a gloss, but as it is readily dissolved by water, it is of little value; sometimes it is employed before using spirit and oil varnishes, to prevent their sinking into the substance varnished; of this we shall speak more fully, when treating of varnishing upon paper. Some writers consider insolubility in water, as an essential characteristic of varnishes, and do not therefore view solutions of gum, as belonging to the number.

Gum tragacanth, also called gum dragon, is sometimes used, as will hereafter appear. This gum does not dissolve like the former, but when covered with water, it swells and becomes a soft pulp, which will mix with other mucilages, and dries hard and glossy, but will not resist water. Most plants contain a considerable portion of gum, and many a very large quantity.

The resins, like the gums, exude from certain trees, either spontaneously, or from incisions made for the purpose. They resemble the gums in external appearance, but differ from them essentially, in many of their properties. The resins are softened and melted by heat, they burn freely, and with a vivid flame, and generally with a fragrant smell. They are insoluble in water, but most of them dissolve readily in alcohol, and, probably, they are all soluble in this fluid, under proper precautions. The resins are precipitated from their solutions in alcohol, by water, a small portion of which, dropped into any spirit varnish, will immediately render it turbid, or milky. This fact should be remembered, as it will be found of importance in the process of varnishing. The resins are generally soluble in ether, and in essential oils; many varnishes are made by dissolving resins, in oil of turpentine; and other essential oils are occasionally employed to promote the solution of some of the most refractory of these substances. The fixed oils dissolve many of the resins. Linseed oil, is the one most commonly used for this purpose, forming what is called an oil varnish. Common rosin, is the most familiar example of the resins. Copal, Mastich, Sanderac, and several others, are also in common use.

There are some substances found in the earth, which strongly resemble the resins in their general properties; of these the most important are amber and asphaltum; both of which are used in varnishes, and will be again noticed in their proper places.

The gum resins are principally used in medicine; they are, as their name indicates, mixtures of resins and gums, which exude together from the same tree. They are dissolved in common spirits, which is a mixture of alcohol and water, the former dissolving the resin, and the latter the gum; they are generally turbid when dissolved, soft and brittle when dried, and partially acted on by water; and, being, therefore, unfit to form the basis of varnishes, do not require from us any further notice.

Brilliancy, hardness, and toughness, are essential properties in varnish. These are possessed in very different degrees by the different kinds. Some of the resins employed, possess one of these properties,

and some another; from this cause, they are frequently used in a state of combination; a portion of hardness, and of toughness, is frequently sacrificed, to obtain brilliancy. Common rosin, which is the most brittle of all the resins, will communicate a high degree of brilliancy to some of the others; it ought, however, to be very sparingly employed, as it in other respects, deteriorates the varnish. It is very cheap, and easily dissolved, and, from these causes the manufacturer of varnishes, not unfrequently, uses it too freely, to the great injury of the consumer. The toughness of a varnish depends, not only on the kind of resin employed, but also on the solvent. The oil varnishes are the toughest, as the oils themselves, when dried, form very tough, and sometimes very good varnishes, without the addition of any resinous matter.

Varnishes differ greatly in the time required to dry them. Some of the resins retain the spirit in which they are dissolved, much more powerfully than others; the spirit varnishes, however, dry the most readily; some of them, in favourable weather, hardening almost as quickly as they can be laid on. The oil varnishes require a greater length of time, than those made with spirit, and the same kind differs greatly in different specimens. Copal, with linseed oil, will sometimes dry perfectly in an hour or two, whilst other portions will require many days, and even weeks, before they are perfectly hard; as this arises from a difference in the oil, it is a point of manifest importance, to understand the cause of these differences, so as to be able to produce, at all times, such an article as may be wanted. We have, in this paper, made those general remarks, which appeared to be necessary to a right understanding of the subject; the whole article will be of considerable extent, and excepting from some accidental cause, every succeeding number of the Journal will contain an essay, until a complete treatise has been furnished.

Some account of the successful operations performed by Mr. Levi Disbrow, *in boring for water, in the vicinity of the town of New Brunswick, in the State of New Jersey.*

TO THE EDITOR OF THE FRANKLIN JOURNAL.

New Brunswick, June 1, 1826.

Sir,—In your number for April last, you ask for some further particulars respecting the recent well, bored by Mr. Levi Disbrow, in this district. The first writer that brought this beautiful art into notice, named these bored wells, *Central Springs*, not only as being more agreeable to the ear, but as indicative of their origin. The Central Spring, therefore, on Mr. Bostwick's estate, still flows, and even more abundantly than at first. It is brought now by pipes, to the house, to the stables, and to the milk house, and it already brings in a vast profit to Mr. Bostwick, independently of all the various benefits derived from it on his farm. Adjoining him is Mr. Mather's distillery, the works of which, being often imperfectly supplied with water, as to quantity, and *always* as to temperature, it was a thing very

desirable to get the surplus water of this Central Spring, which always stands at 52° Fahrenheit, appropriated to its use. An arrangement has, therefore, been made between these gentlemen, by which both are greatly benefitted. By pipes, of *half* the caliber of the main perpendicular tube, through which the water ascends, and inserted in this tube, about four feet *below* the surface of the ground, *one half* of the water goes to supply Mr. Mather's distillery, and the other half furnishes even more than Mr. Bostwick wants for himself. At the depth of four feet, whence the tube now discharges, the water flows at the rate of four gallons, and half a pint, per minute; and, as the distillery is on much lower ground than the place whence the water issues, Mr. Mather gets the full complement. Mr. Bostwick being on higher ground, or rather wishing to get the water to his kitchen and stables, obtains the water at a higher point, by means of a judicious disposition of lateral, and perpendicular tubes, at the rate of one and a half gallons, a minute.

By this arrangement with Mr. Mather, in three years, the cost of the Central Spring will be returned to the spirited gentleman, on whose estate this spring was obtained. This is the second that he has had bored, both of which are now in full operation, and he is certainly entitled, not only to the thanks of the community, but to those of the public at large. So new was the proposal of such a scheme, that few, if any, would have embarked in it, and but for Mr. Bostwick's liberal views and feelings, it is doubtful whether this truly great work, would in our time, have been introduced to the world.

Mr. Levi Disbrow does not affect to consider the art as his own; he knew, and every one knew, that *boring* was a thing known in every part of our western country, and he learned, too, from books, that in Europe, it was *partially* resorted to, when wells became dry; but he considers himself as entitled to the encouragement of the public, because he is the first who formed, and brought to perfection, the plan of bringing fresh water *above* the surface of the ground, for the supplying of farms, and houses.

His eminent success in this, so difficult and new a work, has already drawn forth the attention of those who have been engaged in boring for salt water, and they have encroached on his ground, prematurely; for it should not be disguised from the public, that there is as great a difference between the salt water districts, and those in which the successful experiments have now been made, as there is between the salt and fresh water. Not only a different apparatus for boring, must be used, but the mode of boring is dissimilar; and a salt water borer, can no more use the tools that are necessary to perforate our red freestone and granite, than a manufacturer of clocks, could use those of a watchmaker.

Mr. Disbrow, has overcome all the discouraging obstacles, that beset him in his first trials, and he has reason to hope, that he will ultimately be remunerated for his loss of time and money, in bringing this scheme before the public. He has completed several wells, and is busily engaged with a number of others. He is boring in Albany, Hudson, Horsimus, New York City, Paules Hook, and in your city,

near the Northern Liberties, besides a number of other places at the southward. Several experiments have been made by those accustomed to bore in the salt water districts, but they have failed, merely from a want of knowledge of the peculiar geology of the place. Several failures of this kind will tend to bring the art into discredit; it is desirable, therefore, that publicity should be given to Mr. Disbrow's success, that there may be no disappointment.

As to the *practicability* of obtaining water any where, that does not admit of a doubt. The most unpromising spot for the commencement of such a great work, was chosen by Mr. Disbrow. The wells in the vicinity of those with which he began, were from thirty to fifty feet deep, and were very frequently dry; and the water in Brunswick itself, in which two of the Central Springs are located, is brackish and unpalatable. One Central Spring is thirty-seven feet above the level of the Raritan, another is forty-seven, one forty, and two from four to five. It will soon be acknowledged that water can be brought to the surface, by other powers than those of gravitation, or from the pressure principle; but this part of the subject need not now be discussed. An experiment is immediately to be made at Princeton, on the estate adjoining Richard Stockton, Esq.; and this must be a fair trial, as Princeton occupies the highest point in New Jersey. The novel opinion of water rising to the surface, by other agents than those that exist in the creed of our philosophers, was made public in the American Farmer, of Baltimore. Several scientific gentlemen made some remarks on the subject; they were so thoroughly satisfied with the soundness of the received opinion, which has existed for nearly a century, that they did not encourage a single doubt on the question. Since then, it has occupied the thoughts of many who were not only deeply impressed with the truth of the prevailing theory, but bigotted to their belief; they now have their faith shaken, and a few more successful attempts, in discouraging places, will set the matter at rest with them. C.

FRANKLIN INSTITUTE.

Report of the Committee of Inventions, on an Improvement in Carriages, by which accidents may be prevented. By John S. Williams, Esq. *of Baltimore.*

The Committee of Inventions of the Franklin Institute, having had referred to them, for their examination, an improvement to prevent accidents in carriages, by disengaging the horses, or locking the wheels; for which improvement a patent has been obtained by John S. Williams, Esq. of Baltimore:

Report, that they have carefully examined the model of a carriage, with these improvements; and that the manner in which the horses are to be disengaged, is as follows. The pole and swingle-tree, are retained in their places, by a pin which passes perpendicularly down through them, by which they are affixed to the carriage; this pin is firmly attached to a spring, which, bearing upon it, keeps it securely

in its place; but when this spring is raised, the pin rises with it, and the pole and swingle-tree are disengaged, and the horses, of course, liberated.

To enable the driver to raise the spring with facility, it is terminated by a hook, to which a strap or chain is fastened, the other end of which, may be fixed to the foot board of the driving seat. By pulling this strap, or chain, the disengagement is effected.

For the purpose of locking the wheels, a piece of wood is firmly secured to the perch, or frame work of the carriage, crossing so that the ends terminate within a few inches of each wheel, just within the rim. Upon this piece of wood there are two bolts, sliding through staples; when the wheels are to be locked, these bolts are projected forwards, by two springs, which can be made to bear against them, for that purpose; when projected, the ends of the bolts pass between the spokes of the wheels, close to the felloes, and the wheels are consequently locked. On the front of the foot board, there is a short lever or trigger, with a catch, to which a strap is attached, the other end of which is connected with the springs; by forcing the trigger forward with the foot, the springs are liberated, and act upon the bolts.

This latter apparatus may, undoubtedly, be useful on many occasions, as the driver can lock the wheels, and also liberate them without leaving his seat: the utility of locking, to retard a carriage in descending, or to prevent the horses from running backwards, when ascending hills, is obvious. This can be applied to a carriage with two wheels, where the disengagement of the horse would be inadmissible.

The Committee are aware that the same end has been obtained by other methods. In the year 1802, a patent was granted in England, to Richard Pattinger, for disengaging horses from a carriage, and for an anchor, or drag, to be thrown out to retard it.

At about the same time, a premium was awarded by the Society for the Encouragement of Arts, &c. to William Bowler, for the application of a lever, so as to clip the nave, or hub, of a wheel, to stop its motion.

A patent, with the same date as the first, was obtained by John Lewis, who proposed to lock the wheels by means of a ratchet taking into the nave, or hub of the wheel, and also to disengage the horses.

Another plan was exhibited to the Society for the Encouragement of Arts, &c. by George Davis; in this, the pole was disengaged, and wedges forced forward, so as to press upon the nave or hub, to retard or stop the wheel.

The Committee are informed, that patents have been obtained in this country, for similar objects; but they have never seen any such plan put into operation, nor do they know of any having been made public.

That which has been submitted to them, is much more simple than either of those to which they have alluded, and should it be adopted, particularly in stage coaches, it would, undoubtedly, be the means of preventing many fatal accidents.

Philadelphia, June 17, 1826.

By order,

THOMAS P. JONES, *Secretary.*

Quicksilver Vapour Engine.

"One of the greatest discoveries yet made in navigation has transpired, and the patent has been abandoned in consequence of the technicalities of the Patent Laws. Three-fourths of the fuel now used in steam navigation will be saved. The vapour of quicksilver is substituted for steam, with similar machinery, and a few precautions to prevent any waste of the metal, by a pipe on the safety valve. The bottom of the boiler, which is very small and strong, as compared with that now in use for producing steam, is conical, and the termination of the cone, is in contact with the burning coals which surround it. Their heat is communicated almost instantaneously to the quicksilver in the boiler, throwing it into vapour, at the temperature of 656 degrees of Fahrenheit. Its elasticity and power, can be indefinitely increased by heat, and the greater the elasticity produced, the greater the vacuum in the cylinder, on opening the valve communicating with the well. The saving of stowage will be very considerable, and a ton of quicksilver will be sufficient for propelling a vessel to India, and back again, with an engine of 140 horse power."

We know nothing further of the above, than what appears upon the face of it; we found it in a Journal, and present it to our readers. That it is *possible* to work an engine, with a condensible vapour of any kind, is known to every one who has any pretensions to an acquaintance with the subject; but the eligibility of using quicksilver, appears to us, more than doubtful. The boiler, and also the cylinder in which the vapour acts, as well as all the parts which are immediately contiguous, must be nearly red hot; mercury boils at 656° of Fahrenheit, and it must be somewhat above this point, to keep it in the state of vapour, so as to pass it into the working cylinder; "Sir Isaac Newton ascertained, by a very ingenious set of experiments, that iron is just visible in the dark, when heated to 635°; that it shines strongly in the dark, when raised to the temperature of 752°; that it is luminous in the twilight just after sunset, when heated to 884°; and that when it shines, even in broad day-light, its temperature is above 1000°. From the experiments of Mushenbroeck and others, it appears that what, in common language, is called a *red heat*, commences at about the temperature of 800°."* Probably the temperature of 635° as given above, is rather too low; this appears to be proved by the experiments of Irvine; but let this be as it may, it is evident that the quicksilver engine, must be nearly red hot, when working. It is no easy task to retain the vapour of water in an engine working at 212°, and Mr. Perkins has not been able to make a tight joint, at a temperature of less than half that of the mercurial engine. We are aware that the elasticity of mercurial vapour at 656°, is only equal to that of water at 212°; but the expansion of the metals, would open the joints, and destroy all stuffing, to the pistons, unless they were metallic: but perhaps the inventor, may tell us better.

* Thomson's System of Chemistry, vol. 1, p. 36, American edition.

Should a vessel, furnished with a mercurial engine, make short voyages, the Doctors might find it convenient, to order a trip to their patients, when salivation was thought desirable; but if sent to the East Indies, we think they would go, to "that bourne, whence no traveller returns."

On the High Pressure Steam Engine.

The following article brings again to our notice, the long talked of Steam Engine of Mr. Perkins. Upon this subject expectation remained so long upon tiptoe, without seeing the promised good, that hope itself had almost become extinct. For ourselves, we never believed that Mr. Perkins had discovered any new principle either as regarded the nature, or the application of steam, and have uniformly expressed that opinion. We have long been convinced that the high pressure principle, is, by far, the most economical, and that when properly constructed, engines in which it is applied, are perfectly safe. Could the junctures in Mr. Perkins' engine be made sufficiently tight, and some other practical difficulties surmounted, the extreme high pressure under which the steam is produced, would insure a great saving in the fuel employed, from the known rapid increase of its elasticity; and the smallness of the generator, is calculated to prevent the loss of a large proportion of that heat, which escapes by radiation, from boilers of the large size usually required. This is all that in our opinion, the engine ever promised; should it perform this, it will be valuable; should it do more, we will confess our error, and shall rejoice in the result.

TO THE EDITOR OF THE LONDON JOURNAL OF ARTS, &c.

Sir,—Mr. Perkins' system of generating high steam, has recently been applied to the Cornish, single-stroke pumping engine, by Mr. Samuel Moyle, civil engineer from Cornwall. Although the engine is not yet complete in all its parts, yet enough has been done to prove its great power, and safety. As to the economy of the fuel, although undoubtedly great, nothing decisive is yet known, owing to the imperfection of the injecting pump, which occasionally failed in giving the full supply of water, upon which the proper supply of steam, wholly depends. Enough, however, has been done to establish the important fact, that the higher the steam is used, the greater is the gain. Steam used at 42 pounds per inch, or at 3 atmospheres pressure, without condensation in the cylinder, is undoubtedly not likely to do more, if so much, as the condensing engine, using steam at 3 or 4 pounds per inch pressure. The eduction side of the piston has not only to overcome the pressure of the atmosphere, but the friction of the steam rushing from the cylinder through the eduction pipe, which will amount to, at least, half an atmosphere more, making 21 pounds resistance: add the friction of the piston, piston-rod, and valves, then there will be very little more pressure, if any, on the

inch, than when low condensed steam is used. It would appear that about two-thirds of the 42 pounds pressure on the inch, is lost by the resistance on the eduction side of the piston. But as you increase the pressure of the steam, the gain is almost wholly on the induction side of the piston, since the resistance to the escape of the steam is very little more, whether you work at 500 pounds per inch, or 42 pounds per inch.

The following statements will show the power and safety, although not the amount of the saving of fuel. This engine, with a piston of 9 and $\frac{1}{8}$ inches diameter, and 6 and $\frac{1}{2}$ feet stroke, lifted a column of water 40 inches diameter, and 40 feet high, making 14 strokes of $6\frac{1}{2}$ feet per minute; consuming not more than 120 pounds of coals per hour. But as the engine never worked more than two hours at any one time, it is impossible to say what the actual saving of the fuel would be. After the engine is completed, and worked day after day without interruption, then the economy in the fuel will be clearly ascertained. The area of the pump being 20 times larger than the area of the steam-engine cylinder, and the water being lifted 40 feet high, it balanced the weight or power of 25 atmospheres; but as the friction, &c. must be added to the power required to lift the water, it was found necessary to raise the steam, to about 32 atmospheres, to give a lively stroke to the pump.

The safety of this engine has been proved, by the frequent openings, or fractures, which have taken place, without injuring any one, in the experiments made in generating high steam. The maximum of high steam, has not yet been ascertained; but undoubtedly the higher it can be used, the greater would be the economy. The greater portion of the gain in high steam, appears to be owing to its expansive property. The higher the steam is raised, the sooner the stroke can be cut off; of course more is gained by expansion. The highest Mr. P. has ever used his steam for his steam engines, is 800 pounds to the inch, or about 57 atmospheres.

That the gain goes on in a geometrical ratio, his experiments on the steam gun, have fully demonstrated. In some of those experiments, a pressure of 1600 pounds to the square inch, has been used with perfect safety, and was found to project musket balls of the same weight and distance, one quarter further into the target, than the strongest gunpowder. Mr. P. has made another very curious discovery in experimenting on high steam, namely, that temperature does not always show the true power of the steam, although the steam is in contact with the water from which it is generated, but we cannot be so particular on this point as we could wish, on account of Mr. P.'s not having completed his patent for the remedy.

We feel great pleasure in adding to the above, the testimonials of two gentlemen, whose names are well known in connexion with steam engines.

"We, the subscribers, have for some time past been employed as practical engineers at Perkins and Co.'s Steam Engine Manufactory, in applying Mr. Perkins' system of generating high steam, to the Cornish, single-stroke, pumping engine, of which we have had nearly

twenty years practice. From what we have witnessed, we are perfectly satisfied that no danger can be apprehended from explosions. Its great power is established by the fact of its having lifted a column of water 40 feet high, and 40 inches diameter, with a 9⅛ inch piston. As to the economy of fuel, which is evidently great, we cannot exactly say, owing to some parts of the engine being incomplete, especially the injection pump. The longest the engine has worked at any one time was two hours; at that time it was making 14 strokes per minute, 6½ feet stroke, and lifting a column of water 36 feet high, and 40 inches diameter, consuming not more than 100 pounds of coals per hour. We also certify, that Mr. Perkins' flexible steel piston is quite tight, although, at times, working at a pressure of 50 atmospheres.

HENRY HORNBLOWER,
JOSIAH HORNBLOWER."

FROM THE BOSTON JOURNAL OF PHILOSOPHY AND THE ARTS.

Notice of a Work entitled, "Memorial on the Upward Forces of Fluids, and their Applicability to several Arts, Sciences, and Public Improvements: For which a Patent has been granted by the Government of the United States, to the author, EDMOND CHARLES GENET, *a Citizen of the United States; Member of the Institute of France; of the Royal Antiquarian Society of London; of the Philosophical Society of New York, &c. &c."*

None, more than ourselves, believe that great discoveries are rare. We mean those discoveries, which, in their consequences, improve the physical condition of man, by supplying his wants with less labour, and thus giving him a portion of his time, in which to cultivate his intellectual and moral powers. One of the most sensible questions, in our opinion, that was ever asked regarding the importance of a discovery, was, "Will it reduce the price of grain?" The memorial of Mr. Genet professes to make us acquainted with one of this character; it professes no less than to add another, to the forces, already within the control of the engineer and the manufacturer, which, like the steam-engine, (that it is intended to render obsolete,) may give motion to the thousand complicated devices of human art. We were not born yesterday, and have therefore had an opportunity of knowing that men oftentimes deceive themselves, and sometimes others, into a belief that their discoveries are of greater value than a succeeding age assigns to them. Persons so deceived, however, are, commonly, men of undisciplined minds, men who have not stood before rivals and critics, rising in their despite, to rank with the philosophers and sages of the earth. The author of the book before us, however, is not a nameless man. He is a member of the French Institute, and was, as he informs us, "affiliated to the Academy of Sciences in 1783," before Lavoisier, La Place, or Davy, were known to the world; when, therefore, such a man informs us, that after forty years reflection, he is about to enlighten us upon a subject, which of all

others he has chosen and kept nearest to his heart, we should be lost to humanity, did we not take up his book with a respectful attention.

"The upward forces of fluids!" What can this mean? but let the author speak. "In my meditations on the homogeneity of the forces usually applied to mechanics, I have viewed with astonishment that the force of levity, or the upwards force, should have been entirely overlooked or neglected, when Newton himself had admitted the existence of a drawing force opposed to the force of gravity, which prevents the moon from falling upon the earth; when Herschel had calculated that the force of levity, as exhibited by caloric, was such that it moved in every direction at the rate of 200,000 miles in a second; when the smoke and the vapours of the earth manifested, by their ascension through the atmosphere, that they were impelled by a force acting inversely to the force of gravity; when that same force, which chemistry has proved to be due to caloric, latent or sensible, was known to be the cause of the ascension of balloons; when those aerostatic machines were seen to raise heavy weights in a different tangent from the force of gravity; when the report of the bold adventurers who raised themselves in the air, by means of those aerostats, had testified that equally independent of the general laws of atmospheric pressure and aerometry, the elasticity of aerostats, and the accelerated motion of their ascension, increased as the air grew lighter, and the atmospheric pressure decreased; when it was also stated by them, that as they approached the upper strata of the atmosphere, perhaps occupied by an ætherial gas, at the altitude of 3670 rods, the highest to which men ever have ascended, above the geological crust of the globe, the spirit of life itself seemed to be drawn upwards and to become evanescent, retaining no recollection on its return to vital air, of what had happened during its lipothymy; and when finally it had been proved that the laws of gravity varied in the same body, in proportion of its degree of heat or cold, as it is evinced under the equator and the colder latitudes towards the poles, by the pendulum, retarded when rendered specifically lighter and bulky *by caloric*, or accelerated, when rendered heavier and contracted *by cold*."

Leaving out the theory of the variation of the pendulum, as an extraneous bee in the author's bonnet, the foregoing grotesque paragraph, contains the intellectual germ, which is expanded into the volume of Mr. Genet. The "force of levity" becomes in his skilful hands, a sort of man-of-all-work, that carries canal boats from level to level, without water, raises stranded vessels, recovers foul anchors, saves drowning men, navigates seas, rivers and lakes, and at length disappears in a flying machine that would have delighted the heart of Bishop Wilkins himself. The manner of performing all this, is put down in letter-press, and illustrated by engravings. Take an example. "The moving force," to carry a canal boat to a higher level, "of this machinery is to be essentially the ascensive force of an ærostat [balloon] of a spheroidal form, which, when disengaged and allowed to ascend, will exercise its power on the large wheel, by the means of a rope fastened to its appendice [bottom] that will pass through a

sheeve at the bottom of the pit, to a groove on the rim of the large wheel, and embrace its circumference. The large wheel will besides be supplied with handspikes, to accelerate or retard its motion, or use it separately; and also with a pall, to prevent the load from descending whenever requisite, as it will hereafter be explained. The large wheel, is to be 30 feet diameter and 90 circumference, [in the time of *Metius* every thing of 30 feet diameter had a circumference of something more than 94 feet; but, *nous avons changè tout cela,*] which proportions will give fifteen revolutions of the drum, while the large wheel will perform only one." If this is not intelligible, the reader will understand it when we inform him, that the apparatus consists of wheel work moved by the ascent of a balloon, which, after having risen forty feet, is, we are given to understand, "to be recalled down" by "the individual force of the large wheel," and made to perform a new ascent. But why not use the *descendent* force of a leaden weight, as well as the ascensive force of an air-balloon, to "be recalled up," in the same way that the other is recalled down? or better yet, why not carry up the boat by the "individual" exertion of a horse or a steam-engine, as one Robert Fulton proposed a great while ago?

Another specification of the application of the "upward forces of fluids," is, to the navigation of seas, lakes and rivers. Here Mr. Genet's apparatus, assumes a somewhat different form. The balloon or aerostat, which before floated in air above, has now become a hydrostat, and works in "the floods below." As this new application is founded on an experiment, it may be worth our while to relate it. Mr. Genet took "a small hollow balloon shaped like an oblong spheroid, made of tin, containing in its cavity ½ cubic foot." "Several experiments have been made with this simple *hydroaerostatometre,*" which prove, "That the uplifting force of salt water exercised against the balloon filled with nothing but atmospheric air, supported 47 pounds; which, with the three pound weight of the balloon and its appendages, the weight of the cup and friction of the pullies, amounting altogether to 5 pounds, gives to the upward pressure of salt-water against the inferior surface of ½ cubic foot of atmospheric air so contained, an uplifting force of 54 pounds, and to a cubic foot 108 pounds." pp. 36. 37. This is very important, as a foot of salt water weighs about 64 pounds, and it has been heretofore supposed, that no substance, although devoid of weight, plunged under water, could tend to rise with a force greater than the weight of an equal volume of water; but "*nous avons changè tout cela,*" again. The apparatus which Mr. Genet has contrived, is, as we take it, a *perpetual motion,* and the learned person at the head of the Patent-office, ought, from the rules which he prescribed to himself, some years since, to have refused a patent for it, until Mr. Genet *made it go.*

But the best part of the "Memorial," is the description of the flying apparatus, carrying up two horses to *move its wings,* and fly

> "With restless violence,
> Round about the pendant world."

The author says, "in order to form this new plan, I have consulted nature, which offers in every thing the best, and most perfect models; and I have ascertained by numerous observations, that the plainest way to perfect aeronautics, was to imitate, as nearly as possible, the innate faculty with which nature has endowed the birds and the fishes, to enable them to raise, propel and guide themselves in the fluids, in which they are immersed." p. 68.

Now his imitation of nature, is in the form of a monstrous balloon, which is to be loaded with a windmill and two horses, three men, their attendants, a chemical apparatus, an anchor, fodder and provender, water, provisions for the men, and errors and omissions to the amount of 13,400 pounds. This is an imitation of the innate faculty, with which nature has endowed birds and fishes, with a vengeance.

Our readers are already sufficiently initiated in the mysteries of the "upward forces of fluids," from the specimens here presented. Few of them we apprehend will follow our unprofitable example, for we have honestly read the *Memorial*, from beginning to end.

The work, to which the above "notice" refers, was lately placed in our hands, with a request that we would make such observations upon it, as we might find it to merit. After looking over every page of it, with some care, though we confess we had not the patience of our brother of Boston, who "honestly read it from beginning to end," we were in no small strait; for although the book certainly excited our *admiration*, it could not elicit our praise. If it has any merit, it is as a work of *fancy*, but for this, it is not supposed the author intended it. We were, however, unwilling to interfere with the whimsies, and to disturb the reveries of a very respectable man, who, probably, has cherished fond hopes of this child of old age; it was the more unpleasant to us, as we have had some personal knowledge of the gentleman, and have esteemed him highly. Under these circumstances we had taken up the pen, but the ink would not flow freely; whilst thus engaged, the postman brought the Boston Journal, which happily relieved us from our dilemma, as it supplied us with the foregoing article, in which we found our own thoughts more happily pourtrayed, than the picture would have presented them, had it been drawn by ourselves.

We have also, in our possession, a "*Description of a Guard or Fender, to protect steam-boats against snags, planters, sawyers, shoals, rocks, &c.*" for which a patent has lately been obtained by Mr. Genet. The contrivance is very simple, but we apprehend that it would be found to be altogether ineffectual. He proposes to place a fender of wood, or of iron, so as to project beyond the stem of the boat; this is to terminate in an obtuse angle, and to be attached to two sliders, which slide under the boat, and allow it to retreat, when it strikes against any obstacle. In its retreat, it is resisted by weights, attached to chains, which pass over pulleys; and these weights, force the fender forward. A bell is to be fixed, so as to ring by the motion of the chains, whenever the fender encounters any resistance. This is a fair, and we hope, a distinct outline of the contrivance. Snags,

we believe, usually pass through the bottom of a boat, after the bows have been lifted over it, by the motion of the waves, and this the fender could not prevent, unless placed lower down than would be found eligible; against other obstacles, the momentum of a steamboat, under way, would hardly be defended by the *guard*, and we fear that "the bell" would always ring too late. [*Editor.*

On the Nature and Properties of Timber, extracted from "The Elementary Principles of Carpentry. By THOMAS TREDGOLD."

Wood, is that substance which forms the principal part of the roots, trunks, and branches, of trees and shrubs; and its usefulness in building, and in the mechanical arts, is well known.

The *woods* of different trees differ much in strength, hardness, durability, and beauty, and consequently, in their fitness for the various purposes to which they are applied. The wood which is felled and seasoned for the purpose of building is called *timber;* and in stating the properties of woods, I shall consider those only which are fit for timber.

If the stem, or trunk of a tree, be cut across, the wood is found to be made up of numerous concentric layers, or rings; very distinct in some trees, but less so in others. One of these layers is formed every year; consequently their number corresponds nearly with the age of the tree. Each layer consists, in general, of two parts; the one solid, hard, heavy, and dark coloured; the other of a lighter colour, porous, and soft; which renders the lines of separation, between the annual layers, distinct. Scarcely any two layers of the same tree are precisely alike, either in the proportion of the hard part, or in the thickness of the layers; as the layers vary in thickness, according to the degree of vegetation which took place in the years of their formation: and also in the same tree they vary in thickness, either according to the situation of the principal roots, or the aspect; the annual layers being always thicker on that side of the tree, which has been most favourable to the growth of the roots, or that has had the advantage of a good aspect.

The structure of wood, and the nature of the vessels through which the fluids move, in the living plant, are not thoroughly understood: indeed the study of vegetable anatomy is attended with considerable difficulties; but some important facts have been ascertained, that contribute materially towards a more perfect knowledge of the nature and properties of wood.

Wood, appears to be composed of various vessels, which, in the living tree, convey the fluids necessary to its growth; between those vessels, there are cells interposed. There is nothing of the character of solid fibres in wood, except the thin membraneous coats of the cells and vessels, which adhere so slightly together in recently formed wood, that it is easy to separate them. The vessels in the growing tree, are intended to convey a watery fluid, called the sap, from

the roots to the leaves; when it arrives at the leaves, it undergoes some changes, and returns through the bark; and the bark being expanded by this accession of moisture, rises from the wood, and leaves a cavity that becomes filled with the returning sap, which gradually hardens and forms a new layer of wood. The rising sap flows chiefly through the annual ring, next the bark; and from the experiments of Mr. Knight it appears, that the sap during its ascent dissolves some portion of a substance that had been deposited in the vessels of the wood during the preceding winter, for the nourishment of the buds, leaves, and young wood; hence the flowing sap is more dense in the upper, than in the lower part of a tree. Dr. Darwin draws a like conclusion from the de-barked oaks producing leaves.

In trees, as the leaves expand, the sap ceases to flow, and the bark again adheres to the wood; and from the middle of June, to the middle of August, there appears to be a pause in vegetation; but after this period, the sap again begins to flow, and the bark which adhered so closely in the preceding months, may be separated as easily as in the spring.

The sap which rises through the wood, from the roots, is very different in its nature, from that which descends through the bark to form the new layer of wood. That which ascends, is nearly as liquid as water, and is called the *common sap*. It has, in general, a sweetish taste, and contains sugar and mucilage. It always contains an acid, sometimes in a free state, sometimes combined with lime or potash. When this sap is left to itself, it soon ferments and becomes sour; and when the proportion of sugar is considerable, it will undergo the vinous fermentation.

The descending sap, called the *proper sap*, differs so considerably in different trees, and is so difficult to procure in a separate state, that its properties have not been much examined. It is always less liquid, and contains a much greater proportion of vegetable matter, than the common sap. It is also very probable that trees of the same kind, produce proper sap of different qualities, in different climates, as we find the facts established respecting timber, the growth of one climate are not applicable to the same species of timber, grown in another climate.

That part of the wood next the bark, is called *sap-wood*, because it is through it, chiefly, that the sap ascends; and as it is shown by Mr. Knight to contain the vegetable matter to be expended in forming leaves and buds, it is reasonable to suppose that the sap-wood must be more prone to decay, than the internal part of the tree, called the heart-wood.

As trees increase in size, the oldest part of the sap-wood gradually loses all vegetable life, and the more fluid parts of it, are either absorbed by the new forming sap-wood, or evaporated: its vessels and cells become closed by the pressure of the new forming wood, and it ceases to perform any other part in the growth of a tree than to support it. When these changes have taken place, it is found to be more compact, and generally of a darker colour; and also contains only a small proportion of vegetable matter, besides that kind which is called

the *woody fibre* by chemists. It is then heart-wood, or wood in its most perfect state.

The sap-wood is softer, and generally lighter coloured, than the heart-wood, and contains a considerable portion of vegetable matter, that partakes of the nature of the sap which ascends through it. It is found to decay rapidly, and is also very subject to worms. The reason is obvious, for it contains the food which they live upon, and which is absorbed, or evaporated, from the heart-wood.

The proportion of sap-wood in different trees varies very much: Spanish chesnut has a very small proportion of sap-wood, oak has more, and fir a still larger proportion than oak; but the proportions vary according to the situation and soil. Three specimens of a medium quality, gave the following:

Chesnut, whole age 58 years, 15½ inches diameter, 7 years sap-wood, ⅝ inch thick.

Oak, whole age	63	17	17	1¼
Scotch fir		24		2½

Therefore, if the diameter be unity, or 1, that part of it which is sap-wood, will be, in the chesnut, 0.1; in the oak, 0.294; and in the Scotch fir, 0.416. The Scotch fir was the produce of the Mar Forest.

The life of trees, like that of men, has been commonly divided into three stages; infancy, maturity, and old age. In the first, the tree increases from day to day; in the second, it maintains itself without sensible gain or loss; but, in the third, it declines. These stages vary in every species, according to the soil, the aspect, the climate, or the nature of the individual plant.

Sir H. Davy states, that oak and chesnut trees, decay sooner in a moist soil, than in a dry and sandy one; and their timber is less firm. The sap-vessels being expanded with moisture without the necessary degree of nourishing matter, the general texture becomes necessarily less firm. Such wood splits easily, and is very liable to shrink and swell, with the changes of the weather.

Trees of the same kind, arrive at the greatest age, in that climate which is best adapted to their nature. The common oak, the fir, and the birch, thrive best towards the north; the ash and the olive tree, thrive best towards the southern parts of Europe.

We find, says Mirbel, the ashes of Calabria and Sicily to be longer lived, than those of Prussia or Great Britain. Oak and chesnut trees, under favourable circumstances, sometimes attain an age of about 1000 years; beach, ash, and sycamore, seldom arrive at half that age.

The decline of trees, appears to be caused by the decay of the heart-wood; and it is this, as Sir H. Davy remarks, that seems to constitute the great limit to the age, and size, of trees.

In trees that have not arrived at maturity, the hardness and solidity of the wood, are greatest at the heart, and decrease towards the sap-wood; but in the mature or perfect tree, the heart-wood is nearly uniform; while that of a tree on the decline, is softer at the centre, than it is next the sap-wood. These observations were made by Buffon in the course of his numerous experiments, and also by Duhamel.

Of Felling Timber.

"It should be," says the venerable Evelyn, "in the vigour and perfection of trees, that a felling should be celebrated." When a tree is felled too soon, the greater part of it is sap-wood, and in a young tree, even the heart-wood has not acquired its proper degree of hardness; indeed the whole tree must partake so much of the nature of sap-wood, that it cannot be expected to be durable. And when a tree is not felled till it be on the decline, the wood is brittle and devoid of elasticity, tainted, discoloured, and soon decays. But in trees that have arrived at a mature age, the proportion of sap-wood is small, and the heart-wood is nearly uniform, and is hard, compact, and durable. Hence it is important that Evelyn's precept, should be carefully attended to. It is true, the proper age for each species, has not been satisfactorily determined, but it is a point where great accuracy is not necessary; for half a dozen years in the age of a tree, will not make much difference, provided it be not cut too soon. It is against cutting trees before they have arrived at maturity, that I most protest; and as it is most likely to happen from interested motives, it is the more necessary to caution the carpenter in this respect. Trees increase slowly in size, after they arrive at a certain age, therefore it is the interest of the timber grower, to fell them before they arrive at maturity; because it is his object to obtain the greatest possible quantity of timber, without regard to the quality. But when the carpenter is sensible of the inferior quality of young timber, in respect to duration, it is his province to check this growing evil, by giving a better price for timber that has acquired its proper degree of density and hardness.

The period generally allowed for an oak tree to arrive at maturity, is 100 years, and the average quantity of timber produced by a tree of that age, is about 1½ loads, or 75 cubic feet. In some instances oak trees arrive at maturity, in a less time than 100 years, and in others not till after that period.

The age of an oak tree, according to Daviller, should never exceed 200 years, nor should it be felled at a less age, than 60. Belidor states about 100 to be the best age for the oak. It is much to be regretted, that in districts where the oak flourishes, it is seldom suffered to attain a mature age; being often cut before the trees will produce 50 feet of timber each.

The ash, larch, and elm, should be cut when the trees are between 50 and 100 years old; and between 30, and 50, is a proper age for poplars.

The Norway spruce, and Scotch pine, are generally cut when between 70 and 100 years old in Norway.

In order that timber may be durable, it is also necessary to attend to the proper season of the year, for felling. But on this point, there is much difference in opinion, and it is only to be decided by attending to the state of trees, at different seasons of the year. The most proper period for felling timber, is undoubtedly that in which it is most free from extraneous vegetable matter, or such matter as is intended to be expended in leaves and buds, and which is of a more saccharine and fermentible nature than the proper juices, or such as form the

wood. A tree deposits in the sap-wood, and also in that part of the heart-wood which adjoins it, a portion of matter to be dissolved by the rising sap, and at the period when the leaves are putting forth, the wood must be filled with matter in a state ready for germination; consequently the timber cut at that period, must be easily acted upon by heat and moisture, and subject to rapid decay; or to be destroyed by worms. Now there are two periods in the year, the spring and autumn, when trees are in a state of vegetation; therefore, at these times, it is desirable to avoid felling timber for any other than temporary purposes. Of these periods the spring must be the worst, because then trees contain the greatest quantity of matter, in a state fit for germination.

On the other hand, the best time for felling timber is in mid-winter, or mid-summer; as at these times, the vegetative powers are at rest, or have expended all the most changeable parts, in producing leaves, &c. In some kinds of trees a little after mid-summer appears to be decidedly the best time for felling. Alder felled at that time, is found to be much more durable; and Ellis says, that beech, when cut in the middle of summer, is better, and less liable to worm-eat; particularly if a gash be cut to let out the sap, some time before felling. And as summer felling is an advantage in some species, it seems reasonable to conclude that it will be so in all.

But in oak trees, the bark is too valuable to be lost; and as the best period for the timber, is the worst for the bark, an ingenious method has been long partially practised, which not only secures the bark at the best season, but also materially improves the timber. This method consists in taking the bark off the standing tree, early in the spring, and not felling it till after the new foliage has put forth, and died. For by the production of new buds, the fermentible matter is expended, and the sap-wood becomes nearly as hard and durable as the heart-wood, being both less liable to decay, and to be destroyed by worms.

Buffon has ascertained, by experiment, that the wood is materially improved by this method of barking the trees standing in the spring, and felling them about the end of October. Duhamel, whose extensive knowledge of the nature, and qualities of woods, is well known, recommends the same method; and Evelyn states, that "to make excellent boards and planks, it is the advice of some, you should bark your trees in a fit season, and so let them stand naked a full year before the felling." But a tree will not be benefitted by standing so long; and the best time for felling appears to be when the new foliage has put forth and died, as Mr. S. Pepys observes in his paper on the subject. I am happy to be able to add, that Mr. T. A. Knight, to whom we are indebted for many interesting, as well as important facts, respecting timber, has made some experiments and observations, from which he concludes, that in all cases where it is essential to give durability to the sap-wood of oak, the trees should be barked in the spring, and felled in the ensuing winter.

When the bark of a tree is not of sufficient value to defray the expense of stripping, the timber should be felled during the months of

December, January, and February, in the winter; or during the month of July in the summer. Winter felling, is recommended by most writers. According to Vitruvius, the proper time for felling, is between October and February; and he directs that the trees should be cut to the pith, and then suffered to remain till the sap be drained out. The effusion of the sap, prevents the decay of the timber, and when it is all drained out, and the wood becomes dry, the trees are to be cut down; when the wood will be excellent for use.

A similar effect might be produced by placing the timber on its end as soon as it is felled, and it would no doubt compensate for the extra expense by its durability in use.

In France, so long ago as 1669, a royal ordinance limited the felling of naval timber, from the 1st of October, to the 15th of April. Buonaparte directed that the time for felling naval timber should be abridged, to, from the 1st of November to the 15th of March, in order to render it more durable.

(TO BE CONTINUED.)

On the Preparation of Ivory Paper, for the use of Artists. By Mr. S. EINSLE.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

The properties which render ivory so desirable a substance, for the miniature-painter, and other artists, are, the evenness and fineness of its grain; its allowing all water-colours laid on its surface, to be washed out, with a soft wet brush; and the facility with which an artist may scrape off the colour from any particular part, by means of the point of a knife, or other convenient instrument; and thus, heighten and add brilliancy to the lights in his painting, more expeditiously and efficaciously, than can be done in any other way.

The objections to ivory, are, its high price, the impossibility of obtaining plates exceeding very moderate dimensions, and the coarseness of grain, in the larger of these; its liability, when thin, to warp by changes of the weather; and its property of turning yellow, by long exposure to the light, owing to the oil which it contains.

The candidate produced before the Committee, several specimens of his ivory paper, about an eighth of an inch thick, and of superficial dimensions, much larger than the largest ivory: the surface was hard, smooth, and perfectly even. On trial of these by some of the artists, members of the Society, it appears that colours may be washed off the ivory paper, more completely than from ivory itself, and that the process may be repeated three or four times on the same surface, without rubbing up the grain of the paper. It will also, with proper care, bear to be scraped with the edge of a knife, without becoming rough.

Traces made on the surface of this paper, by a hard black-lead pencil, are much easier effaced, by means of India rubber, than from common drawing paper; which circumstance, together with the ex-

tremely fine lines, which its hard and even surface is capable of receiving, peculiarly adapts it for the reception of the most delicate kind of pencil drawings, and outlines.

An artist of eminence in miniature-painting, (not a member of the Society,) stated, that he has frequently used the ivory paper, and finds it to be superior to ivory itself, in the whiteness of its surface, in the facility with which it receives colour, and in the greater brilliancy of the colours, when laid on, owing to the superior whiteness of the ground. Colours on ivory are apt to be injured, by the transudation of the animal oil, a defect, from which the ivory paper is free.

Some highly respectable dealers in drawing materials, stated, that they have had samples of the ivory paper in their possession for a conderable time, and that it does not appear to become yellow, or discoloured, by keeping.

The valuable properties of the paper appearing thus to be satisfactorily established, a day was fixed for the candidate to disclose his process, and to prepare a specimen of the paper in presence of the Committee. Accordingly, at the appointed time, Mr. Einsle attended, and exhibited before the Committee, his method of preparing the paper: he also gave, in a written account of the process; from which, and from the information obtained during the sitting of the Committee, the following account has been drawn up.

Take a quarter of a pound of clean parchment cuttings, and put them into a two-quart pan, with nearly as much water as it will hold; boil the mixture gently for four or five hours, adding water from time to time, to supply the place of that driven off by evaporation; then, carefully strain the liquor from the dregs, through a cloth; and, when cold, it will form a strong jelly, which may be called, size No. 1.

Return the dregs of the preceding process into the pan, fill it up with water, and again boil it as before, for four or five hours; then strain off the liquor, and call it size No. 2.

Take three sheets of drawing paper (outsides will answer the purpose perfectly well, and, being much cheaper, are therefore to be preferred,) wet them on both sides with a soft sponge dipped in water, and join them together with the size No. 2. While they are still wet, lay them on a table, and place upon them a smooth slab of writing slate, of a size somewhat smaller than the paper. Turn up the edges of the paper, and glue them on the back of the slate; and then allow the paper to dry gradually. Wet, as before, three more sheets of the same kind of paper, and *glue* them on the others, one at a time, carefully removing all air-bubbles, by wiping from the centre outwardly; cut off, with a knife, what projects beyond the edges of the slate; and when the whole has become perfectly dry, wrap a small flat piece of slate, in *coarse* sand-paper, and with this rubber make the surface of the paper quite even and smooth. Then, glue, on an inside sheet, previously wetted, which must be quite free from spots, or dirt of any kind; cut off the projecting edges as before; and, when dry, rub it with *fine* glass-paper, which will produce a perfectly smooth surface. Now, take half a pint of the size No. 1; melt it by a gentle heat, and stir into it three table-spoonfuls of fine plaster of Paris;

when the mixture is completed, pour it out on the paper, and, with a soft wet sponge, distribute it as evenly over the surface as possible. Then allow the surface to dry slowly, and rub it again with fine glass-paper. Lastly, take a few spoonfuls of the size No. 1, and mix with it three-fourths its quantity of water; unite the two by a gentle heat, and *when the mass has cooled, so as to be in a semi-gelatinous state*, pour about one-third of it on the surface of the paper, and spread it evenly with the wet sponge: when this has dried, pour on another portion, in the same manner, and spread it; and afterwards the remainder, and diffuse it uniformly; when the whole has again become dry, rub it over lightly with fine glass-paper, and the process is completed; it may, accordingly, be cut away from the slab of slate, and is ready for use.

The quantity of ingredients above mentioned is sufficient for a piece of paper seventeen and a half inches by fifteen and a half.

Plaster of Paris gives a perfectly white surface; oxide of zinc, mixed with plaster of Paris, in the proportion of four parts of the former, to three of the latter, gives a tint very nearly resembling ivory; precipitated carbonate of barytes, gives a tint intermediate between the two.

Description of a simple Punt-Boat for saving time and labour. By Andrew Waddell, Esq. F. R. S. E.

It is sixty feet long, sixteen feet broad, and four and a half feet deep. It carries its lading upon deck, and it is for the purpose of transporting stones, and other materials, for constructing wears, or breakwaters, and for removing obstructions in dry, and bar, harbours.

In the interior of the boat, below deck, there is a water-tight space, built on one side, occupying about one-third of the breadth of the boat, and the whole of the length, which space, has no connexion with any other part of the interior.

In the bottom of this space, there is an opening with a valve, to shut at pleasure, capable of admitting as much water in one minute, as will sink down that side of the boat, and raise the other; thereby forming an inclined plane, and admitting of the stones, or other material on the deck of the boat, sliding easily overboard into the water, after the manner in which a loaded cart is emptied.

The boat will then instantly resume, nearly, its upright position, and the valve being left open, the water that was admitted into the above mentioned space, will run out again to the level of the water without. The valve is then to be shut, and any water that remains in the said space, pumped out in a few minutes, by means of a wide chambered pump, and the aid of one man.

A boat of this construction will be most useful in forming breakwaters, by dropping the stones at high water, or at any time in deep water, exactly on the spot wanted; but the above mentioned valve, should be made to open and shut with a screw, so that, should the lading be required to be put overboard at different parts, the side of

the boat might be sunk no further, than to admit of a man sliding the stones down one after another.

This boat, when light, draws about one foot and ten inches, and when loaded, about four feet water, which difference of two feet and two inches, when immersed, will displace a body of water equal to thirty-six tons weight, or more.

The bilge keels, attached to the bottom of the boat, are for the purpose of preventing, in some measure, its flat bottom from coming in too close contact with the mud, when deeply laden, which otherwise might prevent the boat from rising with the flood tide, when grounded in such situations; and these bilge keels being firmly united to the bottom of the boat, serve to strengthen the whole of its frame.

[*Edinburgh Journal.*

Different Illuminating powers of strained and unstrained Oil.

Sir,—To your very useful and interesting publication I have been an original and constant subscriber, and have to thank it for many hints which have proved very serviceable to me in the adoption. I therefore owe it much. In part payment thereof, I beg to notice a trifling occurrence which has lately come under my immediate observation, for which I cannot satisfactorily account, and which I do not remember to have seen any where noticed.

I am in the constant, and nightly, habit of burning one of the sinumbra lamps, as I very much prefer its light to that of a candle. I use the best sperm oil that I can obtain. Last spring, having nearly consumed the supply which I had provided for the winter's use, and finding that, towards the bottom of the can, the oil was become thick, and would not burn with so good a light as heretofore, I strained that which remained through a thick flannel, which operation appeared to my eye, only to remove the thick and feculent matter which it contained, the oil which passed through being perfectly clear and pellucid. This *strained oil*, to my astonishment, would not burn in my lamp. Thinking that the fault might rest with the lamp, and that probably it might want cleaning, I sent it up to town for that purpose; when it returned I again tried to burn the same oil, but without success: I then emptied the lamp and introduced a supply of *unstrained oil*, which burned as well as I could wish. Since then I have given the strained oil to my servants, to burn in the stables in a common open tin lamp, with a common cotton wick: they too failed in being able to make it burn, the flame dying away as soon as the wick had burned for a few seconds. The *rationale* of this I wish to account for.

I am, Sir,

Yours respectfully,

Agricola.

[*Lond. Mech. Mag.*

The Editor has been induced to republish the foregoing notice, from the London Mechanics' Magazine, in consequence of having, in several instances, experienced a similar result, from straining oil.

He has used a night lamp, with a very small wick, requiring very good oil. Sometimes, when the oil has become thick, the lamp would require trimming in the night; upon straining the same oil, some change was produced in it, which altogether prevented its burning, the lamp going out very quickly: he has been at a loss to account for this, but of the fact, he is quite certain.

Measuring the contents of Cylindrical Vessels.

SIR,—The following easy method of ascertaining the contents of *any cylindrical vessel*, in gallons, was communicated to me by the late Dr. Evans, the mathematical master of Christ's Hospital.

I have a long time employed this rule to verify my purchases of *oil*, and it has saved me money by detecting errors; and I hope, when known, it will be of service to others.

Rule.—Multiply the diameter of the cylinder by itself; that product, multiply by the depth *in inches* and decimal parts; lastly, multiply this last product by the decimal ,0034, and from this product cut off as many figures as there are decimals in the whole, and the figures or whole numbers are gallons, and the decimals are parts of a gallon.

Example.—Suppose a cylindrical vessel to measure 21,5, say twenty-one inches and a half diameter; and the depth of the oil or other fluid is 76,25 inches, say seventy-six inches and a quarter.

Multiply - - - -	21,5 the diameter,
by itself - - - -	21,5
	1075
	215
	430
	46225
Multiply by the depth - -	76,25
	231125
	92450
	277350
	323575
	352465625
Decimal fraction - -	,0034
	1409862500
	1057396875
	119,83831250

	gals.	*qts.*	*pint.*
Answer - - -	119	3	0¼

One hundred and nineteen gallons, three quarts, and one half-pint.

N. B.—To measure the depth of the fluid you should have a rod marked with inches and parts, but any plain rod dipped into the fluid, and accurately measured to the point of immersion, will be sufficiently accurate. C.

[*Ib.*

On Preparing Oil for Watchmakers.

It cannot but be known to all how much the quality of the oil, used by watchmakers for oiling the works of their delicate machines, is of importance to them.

Colonel Beaufoy remarked, that if olive oil be exposed to the rays of the sun for a considerable length of time, it becomes colourless, clear, like water, free from mucilage, and does not easily freeze. This effect was produced by exposing two half-pint phials nearly filled with oil to the sun-beams for a couple of years; the bottles were uncorked occasionally to let out the gas.

Chevereul has recommended the following process for freeing oil, for the use of watchmakers, from any acid or mucilaginous matter. Put some salad oil into a matrass, or one of the Florence flasks in which it is imported, and pour on it eight times its weight of spirit of wine; heat the mixture until it is ready to boil, then pour off the spirit of wine, and let it stand to cool. A portion of solid, fatty matter, called stearine, separates, and is to be taken away; and then the spirit is to be evaporated away in a basin, or distilled in a glass retort, until only about one fifth part is left; by this means the fluid part of the oil or elaine, as it is called, will be separated and deposited. This elaine ought to have the consistence of oil, be colourless, with little or no taste or smell; it should not discolour litmus paper, neither should it be easily congealable by frost.

On Proving the Colours of Dyed Stuffs.

Proofs are either natural or artificial. The natural proof consists in exposing the dyed stuff to the air, sun, and rain. If the colour is not changed by this exposure, in twelve or fourteen days, it may be considered as fixed. This proof, however, is not adapted for every colour; because some colours will stand this proof, and yet fade in consequence of the application of certain acids; and there are other colours that cannot resist the natural proof, and yet remain unchanged by acids.

Colours, therefore, may be arranged in three classes, and to each of them a different kind of artificial proof is alloted. The first class is tried with alum, the second with soap, and the third with tartar.

For the proof with alum, half an ounce of that salt is dissolved in a pint of water in an earthen pipkin, and into this put half a quarter of an ounce of the dyed thread or stuff that is to be tried; and the whole being boiled for about five minutes, it is then washed with

clean water. In this manner are tried crimson, scarlet, flesh colour, violet, ponceau, peach-blossom colour, different shades of blue, and other colours bordering upon these.

For the proof with soap, a quarter of an ounce of soap is boiled in a pint of water, and half a quarter of an ounce of the dyed thread, or stuff that is to be tried, is put into the liquor, and suffered to boil for five minutes. With this proof all sorts of yellow, green, madder, red, cinnamon, and similar colours are tried.

For the proof with tartar, that substance must be pounded very small, that it may be more easily dissolved; an ounce is then boiled in a pint of water, and a quarter of an ounce of dyed thread, or stuff, is boiled in the solution for five minutes. This proof is used for all colours bordering upon the fallow, or hair brown.

Minimum of Adhesion in Steel, &c.

It is a fact perhaps not generally known to those who have written on the subject, that at the heat called black heat, but which is, in fact, nearly, or quite a red heat in the dark, steel is broken or separated by fracture with much less force than when heated *more, or less*, the requisite temperature varying probably in proportion to the carbon contained in the steel. The disposition to be easily separated by fracture, at a particular heat, exists in carbonated or cast iron, in the alloys of copper and of tin, and is very perceptible in flint glass, and perhaps in all factitious metallic compounds, some requiring a moderate, and others a more intense heat.—*Silliman's Journal.*

Method of Clearing Trees from Worms, Caterpillars, &c.

The following method of driving worms, caterpillars, and all other sorts of insects, from trees, has lately been practised with singular success:—Bore a hole into the trunk of the tree, as far as the heart; fill this hole with sulphur, and place in it a well-fitted plug; a tree of from four to eight inches diameter, requires a hole large enough to admit the little finger, and in the same proportion, for larger or smaller trees. This will usually drive the insects away in the course of forty-eight hours, but uniformly succeeds, perhaps sometimes after a longer period.—*Ib.*

On clearing Feathers from their Animal Oil.

By Mrs. Jane Richardson.

From the Transactions of the Society for the Encouragement of Arts, Manufactures and Commerce.

Take, for every gallon of clean water, one pound of quick-lime; mix them well together; and, when the undissolved lime is precipitated in fine powder, pour off the clear lime-water for use, at the time it is wanted. Put the feathers to be cleaned into another tub; and add to them a quantity of the clear lime water, sufficient to co-

ver the feathers about three inches, when well immersed and stirred about therein.

The feathers, when thoroughly moistened, will sink down, and should remain in the lime-water three or four days; after which, the foul liquor should be separated from the feathers, by laying them on a sieve, to drain.

The feathers should be afterwards well washed in clean water, and dried upon nets; the meshes of which should be about the fineness of those of cabbage-nets.

The feathers must, from time to time, be shaken upon the nets: and, as they dry, they will fall through the meshes; and are to be collected, in order to be beaten, as usual, for use.

The admission of air will be serviceable in the drying; and the whole process will be completed in about three weeks.

To test the value of the foregoing process, several samples of feathers were furnished to Mrs. Richardson, all of which were returned perfectly cleansed from their animal oil; one parcel had been stoved for three days, but still retained their unpleasant smell, which was completely removed by the lime-water.

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After the Feathers have been cleansed and dried, they are put into a strong bag, like a bed tick, which is laid upon a stage, and beaten with long poles, like broom-handles, until the feathers are perfectly light and lively. [*Editor.*

On Browning Copper Medals, Vessels, &c. By T. GILL.

This operation is effected, either by means of Venetian-red or Purple-brown, both being oxides of iron; if, however, the colour of either separately, is not as wished, the two may be mixed together, to produce the desired tint.

The surface of the copper to be browned being well cleaned, the powder is to be mixed with water, to the consistence of cream, and applied, with a soft brush or hair pencil, all over the surface of the article: it is then to be heated, over a charcoal fire, to a sufficient degree to fix the oxide upon the copper. When cold, the superfluous powder must be brushed off; and the medals may then be struck, the vessels hammered, &c.; or, if the articles are to be finished without any other operation, brushing them with a bristle-brush will be sufficient.

Some workmen hold the copper, coated with the oxide, over the smoke produced by putting a little piece of mineral coal into the charcoal fire; and when the stain produced by the smoke upon the copper begins to disappear, they judge it to be hot enough. The great difficulty seems to be in hitting the proper degree of heat; for if it be too great, or too small, the operation will fail, the copper must be re-cleaned, and the process repeated: a little experience will however soon enable the workman to determine the exact temperature.

On Etching and Cleaning Alabaster. By Mr. Henry Moore.

From the Transactions of the Society for the Encouragement of Arts, Manufactures, and Commerce.

Green Hill, Derby, March 16, 1824.

Sir—I send you an alabaster vase, ornamented by a process which I discovered some time ago; and by which process, soiled alabaster sculptures may also be completely cleaned, and rendered equal to new. I beg you to lay the article before the Society for the encouragement of Arts, Manufactures and Commerce, together with the annexed account of the process by which the ornament is effected.

I am, sir, &c. &c. &c.

Henry Moore.

A. Aikin, *Esq. Secretary, &c. &c.*

Taking advantage of the well known fact that gypsum, or alabaster, or sulphate of lime, (for these are only three names for the same thing,) is perfectly soluble in 500 parts of cold water, Mr. Moore has adopted the following process.

He covers the ornament, and all those parts that are not to be corroded, with a composition that will resist water. Wax, dissolved in spirits of turpentine, and mixed with white lead, may be used with a camel hair pencil; or turpentine varnish, with a little animal oil and white lead; this will be found to work more freely than the wax. Spirits of turpentine must be used in pencilling with these compositions. The use of animal oil, is to prevent the varnish from becoming very hard, which would render its removal, after corrosion, extremely difficult. The ornament, and other parts which are intended to be preserved, being completely covered with the composition, it is suffered to remain a few hours, to dry. The article is then put into a vessel of rain water, in which it must remain 48 hours, or longer, according as the ornament may be required to have more or less relief. When the corrosion is completed, the varnish or wax must be removed with spirits of turpentine, which may be applied with a bit of sponge, and then be wiped off with soft rags.

The article, being made quite clean, is now rubbed over with a soft brush, dipped in finely powdered plaster of Paris, which is applied in the dry state. This powder fills the pores of the corroded parts, giving a certain degree of opacity, similar to that which is left from the tools of the sculptor. It forms a good ground that contrasts well with the ornament, and makes it appear with greater advantage than if left merely in the corroded state.

The alabaster of which the vase is made, was procured from a quarry at Chellaston, about four miles from Derby.

To clean Alabaster Sculptures.

Spots of grease are first to be removed with spirits of turpentine; the article is then immersed in water, where it is suffered to remain about ten minutes, or, perhaps, a little longer, if the thing be very dirty; it is then rubbed over with a painter's brush, suffered to dry,

and then treated with plaster of Paris as above, when the article will be found perfectly clean, as if just from the hands of the sculptor.

A piece of sculpture, that would take several days to clean by the usual way, with fish skin and Dutch rushes, is, by this process, completed in half an hour.

On the superior advantages of employing a soft and gentle blast from the Bellows of Smith's Forges, in certain cases, over the sharp blast produced in the ordinary manner of employing them. By DUNCAN CAMPBELL, *Esq.*

Mr. CAMPBELL is enabled by this improvement, to perform many of the most delicate and difficult operations in smithery, and particularly *to weld two pieces of tolerably hard cast steel together*, a thing held to be scarcely possible.

He employs a small pair of smith's bellows, viz. only eighteen inches in breadth, and instead of overloading their upper board with weights, as usual, in some cases *he actually removes much of their own weight, by counterbalancing weights.*

In commencing to heat a mass of iron, Mr. Campbell indeed loads his bellows with weights, but, as the mass becomes heated, and especially when it approaches towards a welding heat, he gradually removes them; and, at length, hangs them upon a hook, attached to a line, passing over a pulley, and affixed to the hinder part of the upper board, so as to take off the greater part of its weight. He can thus keep a mass of iron in a continued heat, as long as he pleases, and cause the heat to penetrate to the interior of the mass, without burning away its exterior, or oxyding it by the force of the blast, as usual. We have thus seen him bring a mass of iron, two inches square, and seven or eight inches long, to a welding heat, without the use of sand, to defend its outward parts in the fire; and to continue it in that state for a considerable length of time.

Mr. Campbell also uses a wider aperture to his bellows and tuyere than is usual; his tuyere is an inch in diameter, and widens towards the forge fire, and it thus diffuses the blast more uniformly than in common.

He assures us, and we do not doubt the fact, that he can lay two pieces of cast-steel, properly shaped, under the hammer for welding, as usual, upon each other, in his forge fire; and, by regulating and tempering his blast, cause them to sweat, fuse, and finally unite together, without hammering!

Mr. Campbell so manages his bellows-handle, by a repetition of short and quick strokes, that towards the end of a heat, he does not ever cause the upper hoop of the bellows to rise, and add its weight to increase the force of the blast. It is also his intention to add a gasometer to his bellows, to equalize the blast, and thus avoid those little irregularities, which at present he unavoidably experiences.

We must own, that in all our experience we have never seen the

forge fire under such absolute command, and such valuable effects produced from it, as in Mr. Campbell's management.

Mr. Campbell does not approve of the cast-iron forge backs, now in general use; which, although durable, nevertheless rob the fire of a very considerable portion of heat. He prefers to employ bricks set in loam for his forge-back; and the little trouble of occasionally renewing it, is more than compensated by its slow conducting power for heat.

Mr. Campbell is particularly careful in the management of his forge fire, by continually adding wetted small coal, and even occasionally sprinkling water upon its exterior surface, to preserve a good *hollow fire* within it.

We need hardly mention the *great ease* with which *bellows loaded with so little weight* can be worked: and indeed the left hand is fully sufficient to keep the blast up, the right hand being employed in governing the weights, and in attending to the management of the fire, and the article to be heated in it. For *working cast-steel*, in particular, where such great nicety in heating it, is requisite, the *soft fire* thus produced, is most admirably fitted. [*Tech. Rep.*

ON GILDING, SILVERING, AND TINNING.

FROM NICHOLSON'S OPERATIVE MECHANIC.

(Continued from p. 309.)

To Whiten Copper and Brass.—Boil six pounds of cream of tartar, four gallons of water, and eight pounds of grain tin, or tin shavings. After the materials have boiled a sufficient time, the substance to be tinned is put therein, and the boiling continued, when the tin is precipitated in its metallic form. Pins are thus whitened.

To Tin Copper and Iron vessels.—Iron which is to be tinned, must be previously steeped in acid materials, such as sour whey, distillers' wash, &c.; then scoured and dipped in melted tin, having been first rubbed over with a solution of sal ammoniac. The surface of the tin is prevented from calcining, by covering it with a coat of fat. Copper vessels must be well cleansed; and then a sufficient quantity of tin with sal ammoniac is put therein, and brought into fusion, and the copper vessel moved about. A little rosin is sometimes added. The sal ammoniac prevents the copper from scaling, and causes the tin to be fixed, wherever it touches. Lately, zinc has been proposed for lining vessels, instead of tin, to avoid the ill consequences which have been unjustly apprehended.

To prepare the Silver Tree.—Pour into a glass globe or decanter, 4 drachms of nitrate of silver, dissolved in a pound or more of distilled water, and lay the vessel on the chimney piece, or in some place where it may not be disturbed. Now pour in 4 drachms of mercury. In a short time, the silver will be precipitated in the most

beautiful arborescent form, resembling real vegetation. This has been generally termed the Arbor Dianæ.

To prepare the Tin Tree.—Into the same, or a vessel similar to that used in the last experiment, pour distilled water as before, and put in 3 drachms of muriate of tin, adding 10 drops of nitric acid, and shake the vessel until the salt be completely dissolved. Replace the zinc (which must be cleared from the effects of the former experiment,) as before, and set the whole aside to precipitate without disturbance. In a few hours, the effect will be similar to the last, only that the tree of tin, will have more lustre. In these experiments, it is surprising to observe the laminæ shoot out, as it were, from nothing; but this phenomenon seems to proceed from a galvanic action of the metals and the water.

To prepare the Lead Tree.—Put ½ an ounce of the super-acetate of lead, in powder, into a clear glass, globe, or wine decanter, filled to the bottom of the neck with distilled water, add 10 drops of nitric acid, and shake the mixture well. Prepare a rod of zinc, with a hammer and file, so that it may be a quarter of an inch thick, and 1 inch long; at the same time, form notches in each side, for a thread, by which it is to be suspended; and tie the thread so that the knot shall be uppermost, when the metal hangs quite perpendicular. When it is tied, pass the two ends of the thread through a perforation in the cork, and let them be again tied over a small splinter of wood, which may pass between them and the cork. When the string is tied, let the length between the cork and the zinc be such that the precipitant (the zinc) may be at equal distances from the side, bottom, and top, of the vessel, when immersed in it. When all things are thus prepared, place the vessel in a place where it may not be disturbed, and introduce the zinc, at the same time fitting in the cork. The metal will very soon be covered with the lead, which it precipitates from the solution, and this will continue to take place, until the whole be precipitated upon the zinc, which will assume the form of a tree or bush, whose leaves and branches are laminal, or plates of a metallic lustre.

Metallic Watering, or Blanc Moiré.—This article, of Parisian invention, which is much employed to cover ornamental cabinet work, dressing-boxes, telescopes, opera glasses, &c. &c. is prepared in the following manner.

Sulphuric acid, is to be diluted with, from seven to nine parts, of water; then dip a sponge or rag into it, and wash with it the surface of a sheet of tin. This will speedily exhibit an appearance of crystallization, which is the moiré.

This effect, however, cannot be easily produced upon every sort of sheet tin, for if the sheet has been much hardened by hammering or rolling, then the moiré cannot be effected until the sheet has been heated, so as to produce an incipient fusion on the surface, after which the acid will act upon it, and produce the moiré. Almost any acid will do as well as the sulphuric, and it is said, that the citric acid, dissolved in a sufficient quantity of water, answers better than any other.

The moiré may be much improved by employing the blow-pipe, to

form small and beautiful specks on the surface of the tin, previous to the application of the acid.

When the moiré has been formed, the plate is to be varnished and polished, the varnish being tinted with any glazing colour; and thus the red, green, yellow, and pearl coloured moirés are manufactured.

Chinese Sheet Lead.—The operation is carried on by two men; one is seated on the floor with a large flat stone before him, and with a moveable flat stone-stand, at his side. His fellow workman stands beside him, with a crucible filled with melted lead; and having poured a certain quantity upon the stone, the other lifts the moveable stone, and dashing it on the fluid lead, presses it out into a flat and thin plate, which he instantly removes from the stone. A second quantity of lead is poured in a similar manner, and a similar plate formed, the process being carried on with singular rapidity. The rough edges of the plates are then cut off, and they are soldered together for use.

Mr. Waddell has applied this method, with great success, to the formation of thin plates of zinc, for galvanic purposes.

To plate Looking-Glasses.—This art is erroneously termed silvering, for, as will be presently seen, there is not a particle of silver present in the whole composition.

On tin-foil, fitly deposed on a flat table, mercury is to be poured, and gently rubbed with a hare's foot; it soon unites itself with the tin, which then becomes very splendid, or, as the workmen say, is *quickened*. A plate of glass is then cautiously to be slid upon the tin-leaf, in such a manner as to sweep off the redundant mercury, which is not incorporated with the tin; lead weights are then to be placed on the glass, and, in a little time, the quicksilvered tin-foil adheres so firmly to the glass, that the weights may be removed without any danger of its falling off. The glass thus coated, is a common looking-glass. About two ounces of mercury are sufficient for covering three square feet of glass.

The success of this operation depends much on the cleanness of the glass; the least dirt or dust on its surface, will prevent the adhesion of the amalgam or alloy.

Liquid Foil for silvering Glass Globes.—No. 1.

1 oz. clean lead,
1 oz. fine tin,
1 oz. bismuth, and
10 oz. quicksilver.

The lead and tin must be put into the ladle first, and so soon as melted, the bismuth must be added. Skim off the dross, remove the ladle from the fire, and before it sets, add the quicksilver: stir the whole carefully together, taking care not to breathe over it, as the fumes of the mercury are very pernicious. Pour this through an earthen pipe, into the glass globe, which turn repeatedly round.

No. 2.——2 parts mercury,
1 part tin,
1 part lead, and
1 part bismuth.

No. 3.——4 oz. quicksilver, and
tin-foil.

The quantity of tin-foil to be added, is so much as will become barely fluid when mixed. Let the globe be clean and warm, and inject the quicksilver by means of a pipe at the aperture, turning it about, till it is silvered all over. Let the remainder run out, and hang the globe up.

New Patents for Inventions and Improvements, issued in the United States, from April 12th, to May 9th, 1826.

Improvements in the rocking washing machine, April 12, John G. Philip, Kinderhook, New York.

In the method of cutting mortices, April 12, Thomas Green, Manlius, New York.

In the pump, April 13, Theodore Brooks, Rutland, New York.

In the tooth of the cultivator, or harrow, April 13, Waldren Beach, Philadelphia.

In the loom for weaving carpeting, April 14, Horace Baker, New York.

In the mode of raising vessels for repairing, April 15, Benj. Waterhouse, N. York.

In distilling spirits from cider and grain, April 15, Samuel Harwood, 3d, Braintree, New York.

In the horse mill, April 15, Admiral Warren, Saugerties, New York.

In the boring and tenoning machine, April 17, Admiral Warren, Saugerties, New York.

In the grist mill, April 18, Moody Stockman, Hampton, New Hampshire.

In the cast iron plough, April 19, Thaddeus Fairbanks, Johnsbury, Vermont.

A conical water wheel, April 19, Boswell Wilcox, Franklin county, Ohio.

In the loom, April 21, Boswell Wilcox, Franklin county, Ohio.

In the vertical saw, for making fret work, April 22, Ebenezer Booth, Southbury, Connecticut.

In the machine for splicing cotton and woollen rolls, April 22, Gardner Barton, Jr. Shaftsbury, Vermont.

In the varnish for furniture, &c. April 22, Marcus Curtis, Troy, New York.

In the mode of picking oakum by machinery, April 24, Ezekiel Waterhouse, Gardiner, Maine.

In the geer for mills, &c. April 24, Charles Wortham, Warren county, North Carolina.

In constructing tan vats, April 24, Aaron Higgins, Florence, Ohio.

In the machine for cleaning grain, of rat dung, &c. April 25, Lemuel Lee and Cornelius Masten, Penn-Yan, Yates County, New York.

In the elevating screw box and cap, of carronades, &c. April 26, Enoch Hidden, New York.

In the machinery for steering vessels, April 26, Stephen G. Clark and Geo. Stimpson, Charleston, Mass.

In the construction of rail roads, April 27, Henry Pinkus and Thos. R. Williams, London, England.

In steam boats for navigating shallow water, April 28, Benjamin Phillips, N. York.

In the plough, April 28, William Cock, Luzerne Township, Pennsylvania.

In the horizontal spinner, May 2, Bemsle Hunt and Seth Wheelock, Knox, New York.

In the machine for pressing bricks, May 2, Julius Willerd, Baltimore.

In the vertical jenny for spinning wool, &c. May 2, James Matthews, Schenectady, New York.

In making artificial globes, May 4, William B. Annin, Boston.

In the inclined horse wheel, May 5, Elias Holliday, Schoharie, New York.

In the machine for moulding brick, May 6, David Watson, Fayetteville, Maine.

In the rail way, May 6, Ethan Baldwin, Harrisburgh, Pennsylvania.

In the machine for thrashing grain, May 9, John Shaw, Kennebec County, Maine.

In the machine for relieving water wheels, May 9, Jare Benedict, Fabius, New York.

In covering or platting brick kilns, May 9, Samuel R. Bakewell, Wellsburg, Virginia.

List of New Patents in England, which have passed the Great Seal, since Feb. 25, 1826.

James Fraser, Houndsditch, London, engineer, for an improved method of constructing capstans and windlasses. Dated February 25, 1826.

Benjamin Newmarch, Cheltenham, Gentleman, for certain inventions to preserve vessels and other bodies from the dangerous effects of external or internal violence on land or water, and other improvements connected with the same. Dated February 25, 1826.

The same, for a preparation to be used either in solution or otherwise, for preventing decay in timber or other substances, arising from dry rot or other causes. Dated February 25, 1826.

James Fraser, Houndsditch, London, engineer, for a new and improved method of distilling and rectifying spirits and strong waters. Dated March 4, 1826.

Robert Midgley, Horsforth, near Leeds, Gent. for a method, machinery, or apparatus, for conveying persons and goods over or across rivers or other waters, and over vallies or other places. Dated March 4, 1826.

George Anderton, Chickheaton, Yorkshire, worsted spinner, for improvements in the combing or dressing of wool and waste silk. Dated March 4, 1826.

James Neville, New Walk, Shad Thames, engineer, for a new and improved boiler or apparatus for generating steam with less expenditure of fuel. Dated March 14, 1826.

Nicholas Hogesippe Manicler, of Great Guildford street, Southwark, chemist, for a new preparation of fatty substances, and the application thereof to the purposes of affording light. Dated March 20, 1826.

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